

# COLORADO RIVER BASIN

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HEARING  
BEFORE THE  
SUBCOMMITTEE ON WATER AND POWER  
OF THE  
COMMITTEE ON  
ENERGY AND NATURAL RESOURCES  
UNITED STATES SENATE  
ONE HUNDRED THIRTEENTH CONGRESS  
FIRST SESSION  
TO  
RECEIVE TESTIMONY ON THE BUREAU OF RECLAMATION'S COLORADO  
RIVER BASIN WATER SUPPLY AND DEMAND STUDY

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JULY 16, 2013



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## **COLORADO RIVER BASIN**

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**TUESDAY, JULY 16, 2013**

U.S. SENATE,  
SUBCOMMITTEE ON WATER AND POWER,  
COMMITTEE ON ENERGY AND NATURAL RESOURCES,  
*Washington, DC.*

The subcommittee met, pursuant to notice, at 2:33 p.m. in room SD-366, Dirksen Senate Office Building, Hon. Brian Schatz presiding.

### **OPENING STATEMENT OF HON. BRIAN SCHATZ, U.S. SENATOR FROM HAWAII**

Senator SCHATZ. Good afternoon.

Today we are here to discuss the Bureau of Reclamation's Colorado River Basin Water Supply and Demand Study. The Bureau and the 7 basin States including Arizona, California, Colorado and New Mexico, Nevada, Utah and Wyoming worked collaboratively with tribes, agricultural users, municipal and industrial water users, power users and environmental and recreational organizations to define current and future imbalances along the Colorado River.

This was quite an undertaking. In fact, I'm told it's the most comprehensive basin wide analysis ever taken up by the Department of the Interior.

The study was finalized in December 2012. We are here today to discuss the study's findings and the next steps.

Unfortunately I have a scheduling conflict and cannot stay to Chair the hearing, but I've spoken with my friend and someone who knows this issue far better than I do, Senator Mark Udall. Given the significance of this topic in his home State of Colorado, he has agreed to chair the hearing today. I look forward to following up with him and the others on the committee on the next steps and anything that I can do in my role as subcommittee chair.

At this time I'd like to recognize our Ranking Member, Senator Lee, for his comments. Then Senator Udall can make his opening statement followed by any other members.

### **STATEMENT OF HON. MIKE LEE, U.S. SENATOR FROM UTAH**

Senator LEE. Thank you, Mr. Chairman and Senator Udall.

It's a pleasure to be here today with both of you. I thank you for leading this effort and this hearing on the Colorado River Basin Water Supply and Demand Study. It was released just a few months ago, last December.

I thank the witnesses for being here today and all of you for joining us as well. I look forward to hearing the testimony.

I especially want to welcome Don Ostler from the Salt Lake City area, from Bountiful, where my sister lives, to the Water and Power Subcommittee. So, welcome.

Water supply has been and always will be a contentious and challenging issue in the American West. The Colorado River is at the heart of it. The river supplies water for millions of Americans and millions of acres of irrigated farmland. It's also the centerpiece of Grand Canyon National Park and many other recreational attractions.

As these varying demands grow so too will the importance of managing the Colorado River in a responsible and circumspect manner which necessarily includes due respect for existing water rights.

The most important fact to consider when examining water supply issues in the Colorado River Basin is that the river and its usage are primarily governed by the Colorado River Compact of 1922. As we hear the details of this report it's crucial to keep in mind that this compact will continue to control water supply decisions along the Colorado River. As evidence of this I might turn attention to the substantial disclaimer in the study that essentially states that nothing in the study is intended for use in any proceeding, whether Administrative or otherwise, that would impact the rights of States or tribes and the Colorado River.

This is not to disparage the study itself, but to place this study in proper context. The report provides valuable information concerning the Colorado River, but does not serve as a foundation for any new regulatory or legislative proposals. The study seeks to inform, but not to direct.

I thank the Bureau of Reclamation for conducting this study and also the witnesses for being here today. This subject impacts families and individuals across the West and is deserving of consideration by this subcommittee.

I look forward to the testimony.

#### **STATEMENT OF HON. MARK UDALL, U.S. SENATOR FROM COLORADO**

Senator UDALL [presiding]. Thank you, Senator Lee.

I want to thank as well, Chairman Schatz for agreeing to loan me his gavel for today's important hearing. He sounded like I was doing him a favor, but in fact he has honored me by giving me an opportunity to chair what is a very important hearing to the State of Colorado and to the entire Southwest.

Senator Heinrich has joined me. He and I called for this hearing earlier in the year because we felt it would be a perfect opportunity to bring our colleagues and the shareholders, stakeholders of all stripes, together to work collaboratively on a path forward. As Westerners and as avid outdoorsmen, the importance of water to our way of life was impressed upon us at a very early age. Much of our careers in public office have focused on solutions to our water challenges.

I again want to thank Chairman Schatz. I appreciate his leadership on the Water and Power Subcommittee. His willingness to

give us time to discuss a topic that's absolutely critical to our future.

As Senator Lee knows water has literally shaped the West. It carved Colorado from red rock. It shaped landmarks from the Rocky Mountains to the Gulf of California.

Water has etched green and fertile valleys into the desert and sustained generations of Americans in the Southwest. Water is literally what makes the West as we know it possible, from our ski resorts in places like Vail and Powderhorn to cities like Gunnison and Grand Junction to farmers in Utah, Arizona and California.

But to understand the role that water has played in the West is to grasp the whole of modern Western history. The saying, "Whiskey is for drinking. Water is for fighting."

Out West, the most important source of water we have is the mighty Colorado, which brings us to today's hearing on the Bureau of Reclamation's Colorado River Basin Supply and Demand Study.

We have an impressive list of witnesses. Two of them hailing from my home State of Colorado. I want to welcome all of them to the committee. I look forward to hearing from all of you in just a few minutes.

Former Colorado Congressman Wayne Aspinall used to say, "In the West, when you touch water, you touch everything." This is certainly the case for the Colorado River Basin.

The Colorado River and its tributaries span parts of 7 States and provide water to nearly 40 million people for municipal use and irrigate nearly 5.5 million acres of land.

The Colorado River sustains at least 22 federally recognized tribes, 7 national wildlife refuges, 4 national recreation areas, 11 national parks and countless ecosystems and fish and wildlife species.

This enormous demand, coupled with climate change and population growth, pose serious challenges for the Colorado River, our economy and our way of life. In order to meet these challenges it is important for us first, to acknowledge that current management and use of the river is unsustainable.

Why do I say that?

When you look at the current long term projections for supply and demand, demand is expected to outpace supply by 3.2 million acre feet by 2060 or enough water to supply 3.2 million homes. Rising temperatures and ongoing drought are only exacerbating the pressure on the Colorado. Insufficient rainfall and snow pack have led to dwindling reservoir levels, leaving water managers with really difficult decisions about how to meet the water needs of cities, farmers and endangered species.

The United States Bureau of Reclamation forecasted below average river flows for 2013, as had been the case for ten of the last 13 years.

In my friend Senator Heinrich's home State of New Mexico, several communities over the last several weeks have literally run out of water due to the drought. At some point soon, there will not be enough water to meet the demands of the almost 40 million people who depend on the Colorado River Basin for drinking water, agriculture, energy, hydropower, recreation and ecosystem and wildlife values.

But as a Westerner—I think Senator Lee and Senator Heinrich would join me in saying this—I'm an eternal optimist, and we still have time to reverse this trend.

Thanks in large part to the Bureau of Rec study, we've been presented with promising strategies that will help to overcome our current challenges as well as our more serious challenges in the future. These strategies, which include reducing demand through innovation, conservation and better management of the supply, will help us prepare for the future and reduce the River Basin's vulnerabilities.

In the near-term, we need to—and I think we must—focus on conservation activities and water reuse and recycling. In short, we need to make every drop count.

This study has been referred to as a call to action by many and rightfully so. It is time to act.

There will, of course, be tradeoffs as we continue to engage all stakeholders on the best way forward. But this study and the procedure it puts forward will get the process rolling to make decisions. It's my hope that today's hearing will support that process and focus us on the necessary next steps.

So I thank you for your attention. I thank the panel for being here. I want to turn to my colleague, Senator Heinrich, for any opening remarks he would like to make.

#### **STATEMENT OF HON. MARTIN HEINRICH, U.S. SENATOR FROM NEW MEXICO**

Senator HEINRICH. Thank you, Senator Udall, Chairman.

I want to welcome all the New Mexicans. Senator Udall said two of the 4 were from Colorado. I count 3 of the 4 from New Mexico. So it's a little bit like being a Marine. Once a New Mexican, always a New Mexican as far as I'm concerned.

But I certainly want to welcome Mr. Darryl Vigil to the committee, a New Mexico native from Dulce and a member of the Jicarilla Apache Nation and the former Water Manager for the Jicarilla Apache Nation, a very important job and the current Chairman of the Colorado River Basin Tribes Partnership.

Welcome, of course, Mike Connor and Tanya Trujillo and say hello to Mr. Ostler. I'm looking forward to your input today as well.

I was home over the weekend. It was just so incredibly striking. I spent 3 days on the road in South Central New Mexico from Socorro down to places like Alamogordo, Ruidoso, met with folks from Cloudcroft and Magdalena.

Magdalena, their sole source well started sucking air about 3 weeks ago. That's never happened before.

We had towns like Cloudcroft that are having water hauled to them as well.

We have towns like Ruidoso and Alamogordo that are struggling with the impact of recent wildfires on those water supplies.

These issues, while there are not directly related to what is going on in the Colorado Basin, are no different than what we see in the Colorado Basin. We're seeing more and more demand, less and less supply. So we're going to have to show some leadership to be able to rise to these challenges.



I want to thank everyone who is here to testify today, to being part of that solution. Because in my view, it is the thing, the greatest challenge for those of us in Western States, is how to learn to live and hopefully thrive in the new normal.

So, thank you very much for the opportunity to say a few words, Senator.

Senator UDALL. Senator Heinrich, thank you.

Let's get right to the panel.

Let me make a brief introduction of each of you and then we'll turn to the Honorable Mike Connor to kick things off.

So we have been joined by the Honorable Mike Connor. He's Commissioner of the Bureau of Reclamation.

Next to him is Tanya Trujillo, Executive Director of the Colorado River Board of California.

Next to Ms. Trujillo, Don Ostler, Executive Director of the Upper Colorado River Commission and as Senator Lee mentioned, a proud resident of the State of Utah.

Next to Mr. Ostler is Darryl Vigil, Chairman of the Ten Tribes Partnership.

All of you, welcome.

Mr. Connor, we'll kick it off with you.

**STATEMENT OF MICHAEL L. CONNOR, COMMISSIONER,  
BUREAU OF RECLAMATION, DEPARTMENT OF THE INTERIOR**

Mr. CONNOR. Thank you, Mr. Chairman, Ranking Member Lee, Senator Heinrich.

I'm Mike Connor, Commissioner of the Bureau of Reclamation. A New Mexican, I'm proud to say. Thank you for the opportunity to be here today to discuss the Colorado River Basin Study and its implications.

There's no question that the Colorado River Basin is one of the most critical sources of water in the West. As you noted, Chairman Udall, the river and its tributaries provide hydropower, supply 40 million people with municipal water, irrigate nearly 5.5 million acres of land and provide the lifeblood for Indian tribes, national wildlife refuges, national parks as well as providing Ag and municipal water supplies to our neighbors in Mexico.

Today the Colorado is facing a record drought. The period from 2000 to 2013 is shaping up to be the lowest 14-year period in the 100-plus years of historical measurements. The complexities of ensuring a sustainable water supply on the over allocated Colorado River has been recognized and documented by all 7 basin States for decades.

It was against this backdrop that the study was conducted with input from a broad range of stakeholders. The purpose of the study was to define the current and future imbalances in water supply and demand over the next 50 years. The study did not result in a decision as to how future imbalances should be addressed. Rather it provides a common technical foundation that frames the range of potential imbalances and solutions that may be employed to address the situation.

The study is an unprecedented joint effort and the most comprehensive basin wide analysis ever undertaken by the Department. It began in January 2010 and was completed in December

2012 at a cost of approximately \$7 million, roughly shared by Reclamation and agencies representing the 7 basin States. The study is a model not only for other Reclamation basin studies, but for collaborative watershed planning across the country.

The study used a scenario planning approach to identify a broad range of future conditions. It considers 4 different water supply scenarios and it is the first basin wide study to incorporate the influence of climate change on future water supply.

A range of future demands were quantified in 6 different demand scenarios that included varied assumptions about economic conditions, population growth and water needs. When the median of water supply projections is compared against the median of the water demand projections, the basin wide imbalance in future supply/demand is about 3.2 million acre feet annually by 2060. The average reduction in hydropower output under this projection is approximately 12 percent but can vary widely under any of the future scenarios.

Over 150 ideas or options were received and organized into 4 groups.

Those that increase basin water supply.

Those that reduce water demand.

Those that focus on modifying operations.

Those that focus on governance and mechanisms to implement the options.

While some may be too costly or technically infeasible, many of the ideas warrant further analysis.

Ultimately this study is a call to action for all who rely on the Colorado River. In response to and consistent with aggressive actions that have been taken in the past 10 to 15 years, a broad group of stakeholders, led by Reclamation and the 7 basin States are moving forward to take the appropriate next steps. These will ensure that continued aggressive actions are taken to address the gap in supply and demand.

These actions will be taken on a strong foundation of recent successes that include the historic 2007 agreement on coordinated operations and shortage sharing as well as the recently completed Minute 319 agreement with Mexico under the 1944 Treaty. These actions, along with others, have resulted in the conservation of over one million acre feet of water that's currently available in Lake Mead. That's ten feet of storage on Lake Mead, the installation of more efficient turbines on existing hydropower units and improved environmental conditions and endangered species populations in both the Upper and Lower basins.

As next steps 3 multi-stakeholder workgroups have been formed to investigate municipal and industrial water conservation and water reuse, agricultural conservation and water transfers and the third group will look at environmental and recreational flows. Additionally the States and Reclamation will lead other efforts to address the situation. For example, Reclamation is working with the Ten Tribes Partnership in the Basin to complete a study related to tribal water needs.

Against this backdrop of collaboration and commitments it is unfortunate to note that the FY2014 Energy and Water Appropriations bill passed by the House of Representatives last week elimi-

nates the vast majority of WaterSMART funding that supported the study and which is key to taking actions necessary to address its findings. Overall the House bill would cut WaterSMART by 53 percent including the elimination of all funding for WaterSMART grants. This action undermines the Federal Government's ability to partner with basin States and local communities on critical investments that are needed to address water resource issues and improve the resilience of the Basin against climate related impacts that threaten both economic and environmental interests.

The Administration urges Congress to restore funding for WaterSMART to the requested level. It is simply imperative that we maintain our ability to respond. As we enter our second decade of drought conditions the communities that rely on the river are being forced to make tough choices.

Tree ring reconstructions of stream flow indicate that the current 14-year period is one of the lowest in not just the last 100 years, but the last 1,200 years. It is likely that climate change will exacerbate ongoing concerns that have major consequences on the Colorado River and those who rely on this oversubscribed resource.

Resolving these challenges is going to take diligent planning and collaboration as well as resources from the 7 basin States, the Federal Government, tribes, water managers, environmental groups and others to find solutions. Fortunately the level of cooperation among key stakeholders has never been higher. As a result there is reason for optimism, even in the midst of the daunting challenges that exist in this basin.

Thank you for the opportunity to discuss this important study. I'll answer questions at the appropriate time.

[The prepared statement of Mr. Connor follows:]

PREPARED STATEMENT OF MICHAEL L. CONNOR, COMMISSIONER, BUREAU OF RECLAMATION, DEPARTMENT OF THE INTERIOR

Chairman Udall and members of the Subcommittee, I am Michael Connor, Commissioner of the Bureau of Reclamation (Reclamation) at the Department of the Interior (Department). Thank you for the opportunity to testify before the Subcommittee today regarding the Colorado River Basin Water Supply and Demand Study (Study). The Colorado River Basin (Basin) is one of the most critical sources of water in the West. The River and its tributaries provide water to nearly 40 million people for municipal use, for irrigation of nearly 5.5 million acres of land, and also it represents the lifeblood for at least 22 federally recognized Indian tribes (tribes), seven National Wildlife Refuges, four National Recreation Areas, and 11 National Parks. Hydropower facilities along the Colorado River provide more than 4,200 megawatts of generating capacity, helping to meet the power needs of the West and offsetting the use of fossil fuels. The Colorado River is also a vital component in fulfilling Mexico's agricultural and municipal water needs in Baja California and Sonora.

Today the Colorado River is facing a record drought. The period from 2000 to 2013 is shaping up to be the lowest 14-year period in the over 100-year historical record for the Colorado River. Tree-ring reconstructions of streamflow indicate that the current 14-year period, which began in 2000, is one of the lowest in the Basin in over 1,200 years. The challenges and complexities of ensuring a sustainable water supply and meeting future demand in the over-allocated and highly variable Colorado River has been recognized and documented by Reclamation and the Basin States of Arizona, California, Colorado, New Mexico, Nevada, Utah, and Wyoming for decades. Looking ahead, concerns regarding the reliability of the Colorado River system to meet water deliveries, power generation, environmental and recreational needs are even greater, given the likelihood of increasing demand for water and projections of reduced supply due to climate change.

It was against this backdrop that the Study was conducted by Reclamation's Upper Colorado and Lower Colorado Regions and the Basin States with participation and input from a broad range of stakeholders including tribes, agricultural users, purveyors of municipal and industrial water, power users, and conservation, environmental and recreation organizations. The purpose of the Study was to define current and future imbalances in water supply and demand in the Basin and the adjacent areas of the Basin States that receive Colorado River water over the next 50 years (through 2060). The Study also included a wide array of adaptation and mitigation strategies proposed by stakeholders and the public to resolve those imbalances. The Study did not result in a decision as to how future imbalances should or will be addressed. Rather, it provides a common technical foundation that frames the range of potential imbalances that may be faced in the future and the range of solutions identified by stakeholders and the public that may be considered to resolve those imbalances. Reclamation has not taken a position on the merits of any of these actions or whether it may ultimately support pursuing any individual actions.

The Study is one of 22 Basin Studies being undertaken by Reclamation and non-federal cost share partners across the West as part of the WaterSMART (Sustain and Manage America's Resources for Tomorrow) initiative. Through WaterSMART, Interior agencies work with state and local water managers to plan for climate change, drought and other threats to water supplies and consider their potentially interrelated and combined effects, and take action to secure water resources for communities, economies, and the ecosystems they support.

The Study is an unprecedented joint effort by Reclamation and the Basin States and is the most comprehensive basin-wide analysis ever undertaken within the Department. It began in January 2010 and was completed in December 2012 at a cost of approximately \$7.0 million, which was roughly equally shared by Reclamation and agencies representing the seven Basin States. This figure does not include the "in-kind" services by all of the other collaborators. The Study is a model, not only for other Reclamation basin studies, but for watershed planning across the country.

The FY 2014 Energy and Water appropriations bill passed by the House of Representatives last week drastically underfunds critical investments that develop American energy sources to build a clean and secure energy future; develop and commercialize the emerging technologies that create high-quality jobs and enhance the Nation's economic competitiveness; and improve resilience against current and ongoing climate impacts that threaten our economy, public health, and natural resources. The bill eliminates the vast majority of WaterSMART funding that supported the Colorado River Basin Study and would significantly hinder actions under the WaterSMART program that could help address water supply shortages in the Colorado River Basin and elsewhere. Overall, the House bill would cut WaterSMART by 53%, including the elimination of all funding for WaterSMART grants, despite already having helped facilitate the conservation of 616,000 acre feet of water from 2010 through 2012. This action undermines the Federal government's ability to partner with local communities on improving resilience against climate-related impacts that threaten a range of economic and environmental interests. The Administration urges the Congress to increase funding for the Bureau of Reclamation to the requested level and to allocate funding to priority conservation, science, and technology programs.

#### THE STUDY BUILDS ON A HISTORY OF COLLABORATION IN THE BASIN

Water managers and water users in the Colorado River Basin have long recognized the need to adapt to and mitigate the impacts of shortfalls between water supply and demand. As early as the 1950s, the estimated annual water use in the Colorado River basin exceeded the annual yield in some years. Prior to that, early water planning efforts resulted in the construction of significant infrastructure such as Hoover and Glen Canyon Dams. This infrastructure—about four years of average natural flow of the river—has helped to avoid past water shortages and to provide substantial power generation benefits to the region. Recently, substantial progress has been made on refining Colorado River water management, including the 2007 interim guidelines for shortage, surplus, and coordinated operations, and the 2012 agreement with Mexico known as Minute 319 to the 1944 Treaty with Mexico. These efforts have resolved potential conflicts in the short and mid-term, are providing operational certainty in that same time frame, and are facilitating conservation actions along with increased water storage that is already helping to alleviate the impacts of the ongoing drought. The benefits of these agreements will continue to accrue for the foreseeable future.

The key to these historic accomplishments was collaboration and partnerships. It is in that same spirit that the Study was conducted. Through monumental outreach efforts, interested parties were engaged and their participation and input was critical to the Study.

#### STUDY APPROACH AND PROJECTED RANGE OF WATER SUPPLY AND DEMAND IMBALANCE

The Study adopted state of the art techniques and approaches to incorporate science, address uncertainty, and assess risk. In particular, a scenario planning approach was used to identify a broad range of future conditions leading to the most robust data generation and analysis of any planning effort in the Basin. The Study considers four different water supply scenarios and is the first Basin-wide study that considers the potential influence of climate change on future water supply. A range of future water demands were quantified in six different demand scenarios that included varied assumptions about future economic conditions, population growth, and water needs for agricultural, municipal and industrial, energy, mineral, and fish, wildlife, and recreation purposes.

The Study confirms that the Basin faces a range of potential future imbalances between supply and demand. Each of those imbalances results in decline in the performance of water deliveries, hydropower, water quality, ecological, and recreational resources. When the median of water supply projections is compared against the median of the water demand projections, the basin-wide imbalance in future supply and demand is about 3.2 million acre-feet annually by 2060. The average reduction in hydropower output under this projection is approximately 12%. However, the imbalance can be much greater, or less, under any one of the multiple future supply and demand scenarios that could occur.

The Study relied upon participants, stakeholders, and the public to provide a broad range of potential options to help resolve the water supply and demand imbalance. The Study then organized over 150 ideas or “options” into four groups: 1) those that increase Basin water supply, 2) those that reduce Basin water demand, 3) those that focus on modifying operations, and 4) those that focus primarily on Basin governance and mechanisms to implement options. The Study explored a wide range of options with the goal of incorporating all viable opportunities, even those that may ultimately be uneconomic or technically infeasible. Reclamation has not taken a position on the merits of any of these actions or whether it may ultimately support pursuing any individual actions.

An effective adaptation strategy would likely include large agricultural, municipal, and industrial conservation and water transfers, and water reuse options. Longer-term solutions are still unclear, and may or may not involve the use of large-scale augmentation, such as ocean desalination.

The Study’s portfolio exploration indicates that implementation of a broad range of options can reduce the Basin’s vulnerability and improve the system’s resiliency to dry hydrologic conditions while meeting increasing demands in the Basin and adjacent areas receiving Colorado River water.

#### MOVING FORWARD AFTER THE STUDY

This Study is not a regional or river basin plan or proposal, or a plan for any Federal water resource project. Rather, Reclamation intends that the Study will promote and facilitate cooperation and communication throughout the Basin regarding the reliability of the system to continue to meet Basin needs. However, In recognition of the enormous challenge facing the Basin states, the Federal Government can provide a leadership role in appropriate processes to facilitate dialogue about addressing water supply and demand imbalances in the Colorado River Basin. As a part of this federal facilitation process, Department of the Interior Assistant Secretary for Water and Science Anne Castle and I participated with representatives from the Basin States, the Ten Tribes Partnership, and conservation organizations in a “Moving Forward” public event in late May. This continuing effort will require innovative thinking, integration of many viewpoints and a commitment to work in a positive and collaborative spirit.

Phase 1 of this process builds on the critical investigations identified in the Study and consists of the formation of three multi-stakeholder workgroups representing Federal, State, Tribal, agricultural, municipal, hydropower, environmental, and recreational interests. These workgroups will investigate: 1) Municipal and Industrial (M&I) Conservation and Water Reuse, 2) Agricultural Conservation and Water Transfers, and 3) Environmental and Recreational Flows. As projects, policies, and programs are developed, consideration will be given to those that provide a wide-range of benefits to water users and healthy rivers for all users. In addition, Rec-

lamation and the Ten Tribes Partnership are jointly pursuing a study related to tribal water use and long-term needs.

It is anticipated that Phase 1 will be completed by 2014, after which Phase 1 efforts will be reviewed, additional phases will be identified, and the process will be reassessed and modified as needed to facilitate anticipated further phases of work. Of course, this new initiative is responsive to the findings of the Study and will be carried out in parallel with ongoing efforts such as continued operations under the 2007 guidelines; implementation of Minute 319; installation of more efficient turbines on existing hydropower units; and actions to further implement endangered species recovery programs in the upper and lower basins. Collectively, these initiatives are critical for short and mid-term operations, even as we seek to improve long-term preparedness in the Basin.

#### CONCLUSION

The Department of the Interior and Reclamation view the Colorado River Basin Study as a critical step to establish a common technical foundation from which important discussions can begin to help ensure the sustainability of the Colorado River system. As we enter our second decade of drought conditions, the communities that rely on the river to sustain them are being forced to make tough choices. Tree-ring reconstructions of streamflow indicate that the current 14-year period, which began in 2000, is one of the lowest in the Basin in over 1,200 years. It is likely that climate change and its emerging challenges will have major consequences on the Colorado River. There is no silver bullet to solve these challenges. Fortunately, the level of cooperation among key stakeholders has never been higher and as a result, there is reason for optimism, even in the midst of the daunting challenges that exist in this Basin. The Department will continue to be a partner in assisting the Colorado River Basin prepare for, and successfully address, the significant issues identified in the Study.

This concludes my written statement. Thank you for the opportunity to discuss these important topics. I am prepared to answer questions at the appropriate time.

Senator UDALL. Thank you, Commissioner.

Ms. Trujillo.

#### **STATEMENT OF TANYA TRUJILLO, EXECUTIVE DIRECTOR, COLORADO RIVER BOARD OF CALIFORNIA**

Ms. TRUJILLO. Thank you very much and good afternoon. It's an honor to be here today. I am Tanya Trujillo, the Executive Director of the Colorado River Board of California. My comments will focus on the Lower Basin States of California, Arizona and Nevada, but I very much appreciate being here with my colleagues from the Federal Government, the Upper Basin States and the basin's tribes as well.

I flew along the Colorado River on my way out here and followed the river from Lake Mead, outside Las Vegas, through the Grand Canyon and into the Western mountains of Colorado. I started that day in Los Angeles where the Colorado River is part of our drinking water supply. In California we appreciate the importance of the Colorado River to our communities and our economies. We understand the diversity of interests that rely on it.

This hearing centers on the Basin study that Reclamation and the States conducted. The study has been a helpful tool that will assist us as we continue to wisely plan for the future. Prudent water management means that we need to be as careful as possible with how water is used and to be creative as possible with respect to development of additional supplies.

Although the Colorado River system is a variable system we have been experiencing a sustained drought for the past 14 years. We know that we need to be able to manage our systems for times of drought.

The Lower Basin States have worked together over the past 20 years to develop strategies to manage the limited Colorado River supplies. We initially developed a system for allocating surplus water because at that time we had been experiencing a few decades of very good hydrology. But we also moved forward to develop a system for addressing potential shortages and developed agreements that provide for water banking and storage so that we have water to save for future uses.

Within California for the past 10 years, our water users have had agreements in place that allow for the transfer of water between agricultural uses and municipal uses. Those agreements preserve the essential agricultural productivity in our State, but also provide for security for our cities. Additional tools such as lining canals and improving irrigation efficiency are also being put into place.

Throughout the Lower Basin our cities continue to develop water savings programs to help reduce our overall per capita water uses. On a basin wide level the basin States and our water users work closely with the Bureau of Reclamation to develop guidelines for the coordinated operation of Lake Powell and Lake Mead. We also worked with Reclamation and the International Boundary Water Commission on a recent agreement with Mexico to allow for flexibility in water deliveries in that system. These types of agreements help us efficiently manage our water supplies.

Although we don't know exactly what the future will hold we can use the 90 years of experience that we have and our recent collaborations to help us address our future challenges. No single strategy will be enough. But through additional conservation, flexible management and the development of additional supplies, we will strive to protect the many important uses on the river.

Although we can always revert back to our respective corners and work to strengthen our historical positions, our current efforts are focused on working together to develop coordinated solutions. These coordinated efforts are not easy and if the hydrology continues to worsen the tensions will increase. But through the rapport and trust that we have developed through the 2007 guidelines and our more recent efforts working together, for example with Mexico, we hope to continue our forward progress.

We know that we need to coordinate with our Federal partners on all of these efforts and with our tribes and with the environmental interests in our States. Working together we can address the challenges that may lie ahead. We look forward to a productive dialog. We think the Basin studies next steps process will be a helpful effort.

Thank you for the opportunity to be here today. I look forward to answering any questions you may have.

[The prepared statement of Ms. Trujillo follows:]

PREPARED STATEMENT OF TANYA TRUJILLO, EXECUTIVE DIRECTOR, COLORADO RIVER BOARD OF CALIFORNIA

Thank you for this opportunity to testify before the Subcommittee regarding the Colorado River Basin Water Supply and Demand Study. I am Tanya Trujillo, Executive Director of the Colorado River Board of California. I appreciate the interest of the Subcommittee regarding this important topic.

# BACKGROUND REGARDING THE COLORADO RIVER BASIN WATER SUPPLY AND DEMAND STUDY

The Colorado River Basin Water Supply and Demand Study (Basin Study) is the latest collaboration between the Department of the Interior's Bureau of Reclamation and the seven Colorado River Basin States of Arizona, California, Colorado, New Mexico, Nevada, Utah and Wyoming. Although this testimony will focus on the perspective of the Lower Division States of Arizona, California and Nevada, the Basin Study is a good example of coordination among all of the basin States, interested water agencies, and others to collectively address the water supply challenges that the basin may face in the future.

The Colorado River Board of California was established in 1937 to protect the interests and rights of the State of California, its agencies, and citizens, in the water and power resources of the Colorado River System. The Colorado River Board of California's member agencies are Palo Verde Irrigation District, Imperial Irrigation District, Coachella Valley Water District, the Metropolitan Water District of Southern California, the Department of Water and Power of the City of Los Angeles, and the San Diego County Water Authority. The Colorado River Board also includes two members of the public and the Directors of the California Water Resources and Fish and Wildlife Departments. California has a normal, annual allocation from the Colorado River of 4.4 million acre-feet of water. Water from the Colorado River is used to irrigate over 700,000 acres of some of the most productive farmland in the country, particularly during the winter. The Colorado River is also a very important component of the water supply for the municipalities in Southern California, which provide water service to around 20 million people.

The Colorado River provides similar benefits within Nevada, providing approximately 90% of the municipal water supply for member agencies of the Southern Nevada Water Authority (SNWA) which include the Cities of Las Vegas, North Las Vegas, and Henderson, as well as Clark County. SNWA has two intakes in Lake Mead at elevations 1,050 and 1,000 feet above sea level; therefore, the future levels of Lake Mead are critical to a continued supply of water for southern Nevada.

The Colorado River is also a vital resource for the State of Arizona. About 39% of Arizona's total water demand is met with Colorado River water. Colorado River water is used to meet municipal, agricultural, industrial and tribal water demands. It is stored underground to provide protection against future droughts and shortages and to conjunctively manage groundwater levels in central Arizona.

The communities that rely on Colorado River water in the Lower Division States are committed to ensuring that they utilize effective water management strategies and continue their ongoing planning efforts to protect and preserve Colorado River resources for many years.

The Colorado River Basin States and the Department of the Interior have worked collaboratively for many years to overcome challenges relating to water allocation and to balance the many interests that exist within the Colorado River Basin. The Basin Study is another example of this successful partnership. The Basin States contributed one-half of the funding to conduct the study and provided extensive background information and technical input during the study. Over a three-year period, the Basin States, individual water agencies, other interested parties and the Bureau of Reclamation worked hand-in-hand to produce the most comprehensive analysis of the Colorado River Basin's prospective water supply and demands to date. This collaborative effort compiled input from interested parties throughout the Basin including environmental organizations, Native American tribes and communities, hydroelectric power and recreational interests, and other federal agencies. The collaboration continues and the ongoing efforts will assist the Colorado River Basin managers in effectively addressing the challenges that lie ahead.

## THE STORY OF THE BASIN STUDY

The Basin Study is the most recent projection of the potential imbalances between water supply and demands in the Colorado River Basin and adjacent areas of the Basin States that receive Colorado River water. The Basin Study incorporates projections based on an evaluation of the potential effects of climate change on runoff within the Basin that may result in even more uncertainty regarding the potential future conditions the Basin may face. By analyzing four different supply scenarios and six different demand scenarios, the Basin Study projects that without continued proactive water management efforts in place, an overall average imbalance between available water supply and potential demands of about 3.2 million acre-feet by 2060, although the range of potential imbalances varied between 0 and almost 8 million acre-feet.



The Basin Study's analysis was not a new concept for the Basin States or the Bureau of Reclamation. Prior studies and analyses also concluded that without development of effective water management strategies to address growing demands for water, an imbalance between available water supply and projected demands could exist. For decades, communities that rely on Colorado River water have made significant investments to conserve water, reuse water, develop supplemental water resources and construct infrastructure designed to efficiently utilize water. The Basin Study reinforces the continued need to implement programs and policies to address the water management challenges associated with the many competing needs for the river's waters.

Consistent with the ongoing practices and strategies for wise management of the Colorado River's resources, the Basin Study identified a broad range of options and strategies to address projected imbalances between supply and demands. The suggestions were gathered from hundreds of perspectives, including the general public. The Basin Study categorized the proposed options and strategies according to whether they were aimed at reducing demands, increasing supplies, or modifying existing operations. All of the recommended options and strategies will require additional review and analysis before any of them can be implemented. None of the recommended options, on their own, would be sufficient to address the projected imbalances, but by grouping options and ideas together and analyzing the effects of combined efforts, a future scenario that maintains the balance between potential future supplies and demands is possible.

The technical team that conducted the Basin Study should be complimented for their competent and professional approach to completing the Basin Study's Technical Reports. The technical work will continue to be essential as the Basin's water managers, agencies, businesses and individuals that rely on the Colorado River, progress forward. The Basin Study is an excellent example of a successful collaborative effort between the Federal Government and the Basin States that builds upon prior successful cooperation and hopefully will lead to successful continued coordination for decades to come. In this regard, the Colorado River Basin can be a model for other complex river systems.

#### CONTINUED EFFORTS TO ADDRESS THE PROJECTED IMBALANCE BETWEEN SUPPLY AND DEMANDS

For more than 20 years, the Colorado River Basin States have been working with the Department of the Interior on ways to better manage the water supplies within the Colorado River Basin. The completion of the Basin Study in December 2012 was another step in the right direction. Since December, the Basin States and Interior have been collaborating with other interested participants to map out the next stages of cooperation. The Basin Study identifies several areas of potential future actions and the Basin States and the Bureau of Reclamation are working to implement each of the Basin Study's recommendations. To evaluate some of these future actions, three workgroups have been formed. The Municipal and Industrial Conservation and Reuse workgroup will evaluate existing programs to refine the estimate of potential water saved through conservation and reuse programs. The Agricultural Conservation and Transfers Workgroup will refine the estimated potential savings from agricultural conservation and transfers. The Healthy Flows workgroup will evaluate potential model improvements for simulating river flows and evaluate certain river reaches.

In conjunction with the release of the Basin Study, the Basin States released a statement confirming their ongoing commitments to future actions. Acknowledging the highly variable nature of the Colorado River system and recognizing that no single solution will be sufficient to meet the future potential water demand and supply imbalances, the Basin States identified a series of local, regional and basin-wide projects that are underway or can be implemented to help meet future demands for water within the Basin. The Basin States confirmed the need to adhere to the "Law of the River", which has served the Basin well for over 90 years and has evolved to meet ever present challenges.

The Basin States recognize that successful ongoing water conservation and reuse efforts have been adopted by many municipal agencies in each State to reduce growing needs for water. In many areas, the per capita use of water is lower now than in the past despite higher populations. Municipalities within the Basin will continue to implement water conservation and reuse opportunities, and are working closely with the other members of the Basin Study's Municipal and Industrial Conservation and Reuse Workgroup to refine the Basin Study's assumptions.

Similarly, the Basin Study's Agricultural Conservation and Transfers Workgroup will document the existing conservation and transfers of Colorado River water

throughout the Basin. Within California, significant amounts of water will continue to be transferred from agricultural to municipal uses pursuant to existing agreements between specific water users. These types of voluntary agreements are designed to provide mutual benefits to the participating agencies and are important tools available to help manage finite supplies of water.

Many of the water providers within the Lower Division States already have been very proactive in meeting existing water supply needs through wise management of the Colorado River's resources, and also have developed additional sources of water, recognizing that developing a balanced portfolio of water supply is a sound water management practice. California's municipal water providers serve close to 20 million of the more than 30 million people who receive at least part of their water supply from the Colorado River. California's municipal conservation efforts include conservation, water recycling and reuse and development of local groundwater resources to supplement water supplies. The Metropolitan Water District of Southern California's 2013 Annual Progress Report to the California State Legislature documents the agency's achievements in conservation, recycling and groundwater recharge. In Nevada, between 2002 and 2012, the Southern Nevada Water Authority's consumption of Colorado River water decreased by approximately 29 billion gallons, despite the addition of 400,000 residents. SNWA has implemented a broad range of education and incentive programs to encourage ongoing water conservation. Arizona has also developed programs to encourage efficient agricultural, industrial and residential water uses and has an extensive groundwater management system in place to try to balance the surface and groundwater uses in Active Management Areas that include the largest population centers of the state.

Water delivery contractors within the Lower Division States, such as the Southern Nevada Water Authority, the Metropolitan Water District of Southern California, and the Central Arizona Water Conservation District are allowed to bank portions of their conserved water supplies and have jointly funded projects to help increase the water resources within the Basin. These States have developed proactive water management agreements regarding how to allocate surplus water when it is available under certain conditions and how to address shortage conditions if the water supply levels deteriorate. On a basin-wide level, all seven Basin States have agreed to coordinated operating guidelines that the Bureau of Reclamation uses to manage releases of water from Lake Powell to the Lower Basin. These types of agreements have set the stage for the continued cooperation that exists today.

The Basin States have also been working to develop basin-wide programs to support weather modification and vegetation management options, and have committed to evaluate additional water supply augmentation options such as large-scale desalination and importation projects that will require extensive planning and research prior to being considered for implementation. The Basin Study's "next steps" outline describes the ongoing commitments of the Basin States to lead efforts to explore additional water banking, water supply augmentation and watershed management options to address short-term and long-term needs for water.

The Basin States will also continue their efforts to assist in implementation of the International Boundary and Water Commission's Minute No. 319 to the 1944 Treaty for the Utilization of Waters of the Colorado and Tijuana Rivers and of the Rio Grande between the United States and Mexico. Executed in November 2012, Minute No. 319 extends some of the water management flexibilities developed within the United States, such as water banking, to the context of the United States' Colorado River water delivery obligations to Mexico. Collaboration with federal, state, and local representatives in Mexico resulted in the development of this mutually beneficial agreement. Continuing to build off the success of Minute No. 319 would result in additional basin-wide benefits.

The collective management efforts among the Basin States, water agencies and the Federal Government have kept the water levels higher in Lake Mead than they otherwise would have been, despite having endured over 10 years of drought. In light of the looming possibility of continued drought and the Basin Study's recent projections of potential supply and demand imbalances, it is more important than ever that we continue to roll up our sleeves and work together to find creative, implementable solutions.

#### THE ROLE OF CONGRESS

The SECURE Water Act, Subtitle F of P.L. 111-11, provided general authority for the Basin Study and provides continued authority for the federal agencies to work with State and local entities to plan for the future and develop water sustainability strategies. Ongoing Congressional support for funding for the Bureau of Reclamation's Water SMART and Title XVI Water Reclamation and Reuse programs would

help continue the beneficial cooperation that currently exists within the Basin. The Water SMART programs are cost-shared by the non-federal participants and provide assistance to local water management entities that are attempting to conserve water and maximize water use efficiency. Investments in existing water supply infrastructure to ensure that the operation of existing facilities can be as efficient and secure as possible and continued funding for water efficiency and conservation programs that are matched by or enhance the ongoing efforts at the state and local levels are helpful tools that should continue.

#### CONCLUSION

The Colorado River Basin States recognize that we are part of a complex community that relies on a vitally important shared natural resource and involves diverse areas of responsibility. The impacts of continued drought are being felt by all of the varied users of water within the Basin States. The Basin States plan to continue our successful collaborations, including the recent successes with Mexico, to develop tools and strategies to enable us to address ongoing challenges and meet the evolving demands on the Colorado River. The Basin Study's technical foundation will help support that process.

Thank you for the opportunity to provide testimony on this important topic.

Senator UDALL. Thank you, Ms. Trujillo.  
Mr. Ostler.

#### **STATEMENT OF DON A. OSTLER, EXECUTIVE DIRECTOR, UPPER COLORADO RIVER COMMISSION**

Mr. OSTLER. Good afternoon, Mr. Chairman and subcommittee members. Thank you for the opportunity to present testimony on this important topic.

My name is Don Ostler. I'm the Executive Director of the Upper Colorado River Commission. My Commission was created by ratification of the 1948 Upper Colorado River Basin Compact. It's comprised of members appointed by the Governors of the 4 Upper Basin States of Wyoming, Utah, Colorado and New Mexico and one member appointed by the President to represent the interest of the United States.

As we talk about the study it's important to recognize that this is not the first study of its kind in the Colorado River Basin. The States and Reclamation and others have been doing studies of supply and demand for many years. For example, the Upper Basin has completed numerous studies to determine the safe annual yield of the Upper Colorado River to determine our safe development levels.

It has already been mentioned that 2007 interim guidelines is an action taken to help us manage shortage and coordinated operations.

It's also been mentioned that Minute 319 for the Mexican Water Treaty is a monumental action to help Mexico share in shortage, give them tools to address shortages and mitigate shortages, but better yet, to potentially augment the supply for all the users of the Colorado River Basin.

These types of actions including the study that we're talking about today are possible only by recognizing the close relationship that exists between the Department of the Interior, the Bureau of Reclamation and the States. The States, after all, are the managers of the water within their boundaries. They're the direct link to water users on the ground.

Reclamation and the Department of the Interior is the water manager for the Lower Basin and they operate the reservoirs that we depend upon.

The Upper Colorado River Commission is the water manager for the water master for the Upper Basin.

Now a word about the Study.

The Basin study is an important step to refine and help us improve our strategies and options to address the supply and demand imbalance. The results of this study are no surprise the basin States. We have seen supply and demand imbalance projections before. This is a refinement at a level that is unprecedented, however, in terms of the level of this study.

Another thing to remember with regards to this study is there are great uncertainty with regards to projections of the future. A good thing about this study is that it took a scenario approach to assume many different scenarios for demands in the future and many different scenarios for supply in the future. So that we have good data, regardless of which of those scenarios turn out to be true and we can plan for all of those scenarios which is the appropriate thing to do, in my opinion.

Another thing that we learned from the study is that no single strategy will solve our vulnerability by itself. We need to implement a portfolio of actions in order to address and reduce the vulnerability of this entire basin to shortage. Those actions could include conservation, changing management approaches, as well as augmentation.

Finally, even if we do that, we still will have to have good shortage management plans because vulnerability in this basin will not be entirely eliminated with the strategies that we're looking at. But we can manage. We can make things bearable as we go through extreme droughts.

I would like to just simply mention a couple of things that are different from the strategy between the Upper Basin and the Lower Basin.

The Upper Basin States, which I represent, have additional water to develop from the Colorado River according to the compact and according to the safe annual yield of the river.

Second is climate assumptions. Probably are the most significant impactor of our vulnerabilities in the Upper Basin, even more significant than the various ranges of development or demand growth.

Finally the Upper Basin experiences shortages now every year. Those shortages are in the tributaries usually where we do not have storage. They exist now and they will continue in the future unless we find some way to provide storage for those tributaries. That's no possible in all of them.

So shortage is a fact of life.

The Lower Basin, on the other hand, is at full development of all the water really that's available from the compact. They face imminent system shortage. They face much greater problems of serving additional growth.

So I think the importance of this is that, I think, all of the States are lined up to initiate the next steps. No one wants to see this study sit on the shelf. I think actions have been taken under the leadership of the Bureau of Reclamation, the Department of the In-

terior and the States to further move toward implementation strategies.

I'm optimistic with the foundation that we have, with our past working relationships, with proper attention to the role of each of the entities that are represented at this table, that we can greatly improve our future and manage through the droughts that we are expected to see.

Thank you.

[The prepared statement of Mr. Ostler follows:]

PREPARED STATEMENT OF DON A. OSTLER, EXECUTIVE DIRECTOR, UPPER COLORADO RIVER COMMISSION

INTRODUCTION

Good afternoon Chairman Schatz and members of the Subcommittee. Thank you for the opportunity to provide testimony on the important topic of the December 2012 Colorado River Basin Water Supply and Demand Study. My name is Don Ostler and I am here today as the Executive Director representing the Upper Colorado River Commission (the Commission). The Commission is an interstate water administrative agency created by State and federal ratification of the 1948 Upper Colorado River Basin Compact (Compact). The Commission is comprised of one person appointed by the Governor of each of the Upper Division States of Wyoming, Utah, Colorado and New Mexico. In addition, the President appoints one Commissioner to represent the United States. The responsibilities of this Commission include performance of all functions required of it by the Compact. Among the duties assigned include engaging in cooperative studies; making findings of the annual quantity of water used in the Upper Basin; making findings of the water deliveries to Lee Ferry (the Lower Basin); making findings of the necessity for and extent of curtailment of use required by the Compact; making findings of the quantity of reservoir losses and the share chargeable under the Compact to each state and finally; making findings of fact in the event of the occurrence of extraordinary drought or serious accident to the system in the Upper Basin which may affect the United States' obligations under the Mexican Water Treaty of 1944. As you can see, this Commission has been and will continue to be critically involved along with the Upper Division States in the administration of Colorado River water. The Upper Basin includes the Colorado River and all tributary waters that drain into the River above Lee Ferry Arizona, a point about 16 miles downstream from Glen Canyon Dam. The Lower Basin includes the Colorado River and all tributary water draining into the River downstream of Lee Ferry Arizona prior to its passage into Mexico and includes water users in Arizona, Nevada, California and small parts of New Mexico and Utah.

ROLE OF THE STATES AND THE COMMISSION IN THE BASIN STUDY

The Colorado River Basin States and the Commission have long been involved in planning for development of the Colorado River water supply including forecasting supply and demand issues and developing strategies to address potential problems. For example, the Commission and Upper Basin States in partnership with Reclamation have conducted several hydrologic studies to determine the safe annual yield of the Colorado River in the Upper Basin. These studies have been used to guide development and use of Colorado River water in the Upper Basin. The seven Colorado River Basin States in cooperation with Reclamation have a history of working together to identify problems in advance and to cooperatively craft strategies to mitigate or avoid anticipated problems without disturbing the "Law of the River". Recent examples of this include the development of Interim Shortage Guidelines and Coordination of Reservoir Operations in 2007 to mitigate or avoid the effects of drought. In addition, the States recently played a major role along with the Department of the Interior (DOI) in initiating and conducting discussions with the government of Mexico to establish Minute 319 to the Mexican Water Treaty of 1944. This Minute allows Mexico to participate in shortage management and mitigation along with the United States and provides tools for conservation and possible future augmentation of the supply to the benefit of both nations. Throughout these processes, the States and the Commission have enjoyed a close working relationship with the DOI, working primarily with the Bureau of Reclamation to cooperatively identify and address problems within the Colorado River System. Maintaining this

relationship is the key as we address future problems of supply and demand inasmuch as the states have the primary responsibility for managing water within their boundaries and are the principal link with actual water users. DOI is the water master for the Lower Basin of the Colorado River and the operator of many of the large storage reservoirs that we depend upon, and the Commission is the water master for the Upper Basin.

#### THE 2012 BASIN STUDY (BASIN STUDY)

The seven Colorado River Basin states and the Commission, being fully aware of future supply and demand imbalances, sought funding jointly with the Upper and Lower Colorado River Regions of the Bureau of Reclamation for the Basin Study through the DOI WaterSMART Program. The Basin States contributed 50% of the expense of this study and along with the Commission, fully participated with Reclamation in management and direction of the study. This study provided a vehicle to update and refine information from previous studies done by the various states and others with more specifics as we move closer to implementation of strategies to address supply and demand imbalances. As such, the overall imbalance identified in the study was not a large surprise to us or to the Lower Basin States. There is considerable uncertainty in projecting future conditions in the Basin. Therefore the study identified numerous scenarios for anticipated future supply and demand conditions and then provided identification and evaluation of options and strategies to address supply and demand imbalances. The median of supply and demand imbalances projected through the year 2060 was 3.2 million acre-feet for the entire Colorado River Basin. A large number of options and strategies were evaluated to decrease system vulnerability. These included many different means to reduce demand, increase the supply and modify operations. It is clear from the study that no single option is adequate to significantly reduce vulnerability. It will require a portfolio of effective options and strategies to be implemented to accomplish this. Even then, system vulnerability will not be fully eliminated so shortage management plans during the worst drought conditions will still be required. It is important to note that both the Upper Basin and the Lower Basin face challenges, but the problems are different for each basin. The Upper Basin has yet to develop its full 1922 Compact apportionment and will continue to develop its supply. Such development will continue to be tempered by better knowledge of future supply, more efficient management of water use and our ability to tolerate drought through development of management options. The study shows that the probability of a Compact driven curtailment of use, (or Compact call), is low for the Upper Basin over the 50 year study period even with additional projected growth in water use. The most significant factor affecting this probability is the assumptions used to estimate future supply including global climate models. It is also important to understand that significant local hydrological driven shortages, primarily on smaller tributaries without sufficient storage, exist now in the Upper Basin every year and will continue. The Lower Basin, which has not had to endure shortages to date, has already developed its full 1922 Compact apportionment and faces much more imminent potential of system mandated shortages as well as greater challenges about how to meet the needs of future municipal and industrial growth. Although the problems faced by the two basins are different, many problems are common. Because of coordinated reservoir operations, problems or shortages in one basin can have an impact on the other basin. The seven Basin States recognize the significant commonality of our vulnerabilities to supply and demand imbalance and are committed to mutual coordinated efforts to address problems.

#### NEXT STEPS

The Basin States, the Commission and the Department of the Interior all recognize that we must move immediately to address the vulnerabilities identified in the Basin Study. In doing so it is imperative that the close working relationship between DOI and the Basin States is maintained and that all parties move forward in a coordinated fashion respectful of the various roles and responsibilities of the entities involved. The Colorado River Basin remains in a very severe 14 year drought, the continuation of which could drive Lake Powell to levels that threaten the ability to generate electrical power and Lake Mead to levels that require implementation of shortages within a few years. It is for these reasons that the states and DOI are initiating a "Next Steps" process now to address vulnerabilities. Plans have already been put in place to formulate workgroups of state, DOI and stakeholder representatives to further refine options and strategies that may be implemented in both the near and long term. The seven Basin States and the Commission will continue their efforts to address near and long term water supply short-

ages. We will continue to need the full support of DOI as we address these difficult issues in partnership. The modeling, technical expertise and policy guidance of Reclamation as well as continued Congressional support of financial resources such as the WaterSMART Program are essential in moving forward with next steps. I am confident that in a collaborative approach relying upon the sound relationships that we have built in the past, we have the ability to address these problems before us. Thank you for your time Mr. Chairman and Subcommittee members.

Senator UDALL. Thank you, Mr. Ostler.  
Mr. Vigil.

**STATEMENT OF T. DARRYL VIGIL, CHAIRMAN, COLORADO  
RIVER BASIN TRIBES PARTNERSHIP**

Mr. VIGIL. Good afternoon, Chairman Udall, Ranking Member Lee and my Senator, Senator Heinrich. I'm Darryl Vigil. I'm a member of the Jicarilla Apache Nation and Chairman of the Colorado River Basin Tribes Partnership. Thank you for the opportunity to testify before the subcommittee today regarding the Bureau of Reclamation's Colorado River Basin Water Supply and Demand Study.

The partnership was formed in 1992 for the purpose of member tribes joining together to develop and protect tribal water resources and to address technical, legal, economic and practical issues related to the operation of the Colorado River that would affect the interests of the Ten Tribes of federally recognized reserved water rights in the Colorado River and its Upper Basin tributaries. The Ten Tribes are located in both the Upper and Lower Basins of the Colorado River.

The tribes located in the Upper Basin are the Ute Indian Tribe of the Uintah and Ouray reservation, the Ute Mountain Ute Tribe, the Southern Ute Indian Tribe, the Jicarilla Apache Nation.

The tribes located in the Lower Basin are the Chemehuevi Indian Tribe, the Cocopah Indian Tribe, the Colorado River Indian Tribes, Fort Mojave Indian Tribe, the Cocopah, I mean the Quechan Indian Tribe.

One tribe, the Navajo Nation, is located in both the Upper and Lower Basins.

The partnership is a member of the Colorado River Water Users Association and the immediate past Chairman of the partnership, George Arthur, serves as the current President of the Colorado River Water Users Association in his capacity as representative of the Partnership.

The study identified 29 federally recognized tribes in the Colorado River Basin with claims to the use of water from the Basin. To date there has been recognized, either through Federal and State court decrees or Congressionally approved tribal water settlements that tribes in the Basins have a right to divert in excess of 2.9 million acre feet per year from the Colorado River and its Upper Basin tributaries of which the Ten Tribes have a right to divert an excess of 2.3 million acre feet.

Because not all the tribes in the Basin or all the Ten Tribes have had their water rights determined this amount will increase in the future as final resolution of tribes' water rights are achieved. Given that the observed historical on term mean natural flow of the Colorado River is approximately 15 million acre feet per year, it is clear that the Tribes' rights constitute a significant quantity of the his-

toric long term mean natural flow and need to be fully addressed by the basin States and the United States in the ongoing Basin study.

The Ten Tribes in the Basin use water for multiple purposes including irrigation, recreation, domestic, commercial, wildlife, in stream flows, habitat restoration, municipal, industrial, mining, power generation, cultural and religious activities to list a few. The Ten Tribes are working hard to put the water to which they are entitled to use for the benefit of their tribal members. But water development on reservations has proven to be difficult and slow frustrated in large part by the Federal Government's general unwillingness to fund water infrastructure for the benefit of the tribes.

The Ten Tribes are very concerned while they struggle to put their water to use, other with far more political clout are relying on unused tribal water supplies and will seek to curtail future tribal water use to protect their own uses. Stated another way, the Ten Tribes are concerned about the impact on other water users when the Ten Tribes' water rights are put to full use for the benefit of tribal members and how that will affect the ability of the Ten Tribes to put their water to use.

At the outset of the study the Ten Tribes were not represented on the steering committee established for the study. Membership was limited to the representatives of the Bureau and the basin States. Nor did the Ten Tribes feel that they had much of a role in it because they were neglected in participation on sub—that they were relegated to the participation on sub-teams that were used to develop technical data for the study.

Because it appears that the study was to be a decision document which could significantly adversely impact tribal water rights and the tribal usage of water in the future exclusion from the steering committee became a matter of great concern of the Partnership. This shortcoming and other concerns were raised with the Bureau of Reclamation reminding the Bureau of the United States trust responsibility to them in the protection of the water and of the tribe's sovereign status and control of their water.

The Partnership suggests that the following steps be taken to address their concerns about the study.

One, acknowledge and protect early priority of tribal water rights.

Two, recognize and protect and use allocation of tribe's quantified water rights.

Three, recognize and protect unquantified tribal water rights.

Four, recognize the special status of tribal reserve water rights that is embodied in Federal statutes and State case law.

Five, provide a seat on the steering committee for the Partnership.

Six, require the Colorado River simulation system model quantify the extent to the reliance of water users on the decreed and undeclared rights of the tribes not being fully exercised.

In response to the concerns by the Partnership, the Bureau, much to its credit, undertook outreach to all the tribes to explain the purpose of the study, acknowledged the tribes water rights and reaffirmed the United States trust responsibility to the tribes.



The Bureau assured the Partnership the study was not intended to serve as a decision document, but was a first step in identifying what the potential imbalances of the Basin water supply and demand may be in the future and in identifying possible solutions to resolve these—those imbalances that deserve additional study and analysis.

Because of the limited scope of the study the matters raised by the Partnership would not be addressed in the first step study. But those matters would be appropriate for further study. With that understood—with that understanding and as a result of the Bureau's outreach efforts, a number of tribes actively cooperated with the Bureau in providing data for the study.

The outreach provided—proved to be successful. The results are reflected in Appendix C9 of the study which contains a tribal water demand scenario quantification. Although as noted, a number of the tribes actively participated in the data collection needed for the study, the Partnership was still wary that the information in the study regarding tribal water might be used to their detriment and recommended that a disclaimer about the study be incorporated into it.

The import of which is nothing in that study is intended to nor shall the study be construed so as to interpret, diminish or modify the rights of any federally recognized tribe pursuant to Federal and State court decrees, treaties, agreements, executive orders and Federal trust responsibility. Further, the disclaimer acknowledges that the Bureau and the basin States would continue to recognize the entitlement and right of each State in any federally recognized tribe under existing law to use and develop the water of the Colorado River system. Through the cooperative efforts of the Bureau personnel the Basin State representatives and tribal representatives, a disclaimer was developed and agreed upon. It is found at Executive Summary -22 in the Executive Summary of the study.

Inclusion of the disclaimer was an important aspect of the study for the Ten Tribes and laid the foundation for future work with the Bureau and the basin States in the next steps phase of the study. Because the Ten Tribes have significant quantities of recognized water rights which will increase as the remaining rights are fully quantified, any study of water in the Basin must—

Senator UDALL. Mr. Vigil, your statement is very important. The entire statement will be included in the record. I do want to get to questions. I'm worried that, frankly, if you complete your statement we'll be quite a bit into the time that we all have.

So can I ask you to summarize?

Mr. VIGIL. Sure.

Senator UDALL. Then we can turn to questions.

Mr. VIGIL. Absolutely.

Senator UDALL. I would say this with all due respect and I think I can speak for all the members of the committee. We support the Native American community's requests in historic access to this water. We will work with you to ensure that your concerns are met.

Mr. VIGIL. Sure. If I could read my conclusion statement, that would be great. Thank you.

In conclusion, Mr. Chairman, I would be remiss to not acknowledging the yeoman's work performed by Carly Jerla and Pam

Adams of the Bureau of Reclamation in reaching out to the tribes and tirelessly advocating on the tribes' behalf and ensuring the tribes' concerns were addressed. This effort resulted in the tribes actively participating in the study. Their efforts were fully supported by Commissioner Connor, Assistant Secretary Castle and Regional Directors of the Lower and Upper Basins, Terry Fulp and Larry Walkoviak.

I also wanted to note the cooperation and thank the Basin State representatives in working with the Partnership in developing the disclaimer contained in the study.

Last I wanted to thank Cathy Condon and Chuck Lawler from the Partnership for their work in coordinating tribal and Bureau work which resulted in an improved study and better understanding of tribal water issues for all concerned.

Thank you.

[The prepared statement of Mr. Vigil follows:]

PREPARED STATEMENT OF T. DARRYL VIGIL, CHAIRMAN, COLORADO RIVER BASIN  
TRIBES PARTNERSHIP

Chairman Schatz and members of the Subcommittee, I am Darryl Vigil, a member of the Jicarilla Apache Nation and Chairman of the Colorado River Basin Tribes Partnership ("Partnership"). Thank you for the opportunity to testify before the Subcommittee today regarding the Bureau of Reclamation's Colorado River Basin Water Supply and Demand Study ("Study").

BACKGROUND OF THE COLORADO RIVER BASIN TRIBES PARTNERSHIP

The Partnership was formed in 1992 for the purpose of member Tribes joining together to develop and protect tribal water resources and to address technical, legal, economic and practical issues related to the operation of the Colorado River that would affect the interests of the ten Tribes with federally reserved water rights in the Colorado River and its Upper Basin tributaries ("Ten Tribes"). The Ten Tribes are located in both the Upper and Lower Basins of the Colorado River. The Tribes located in the Upper Basin are: Ute Indian Tribe of the Uintah and Ouray Reservation, the Ute Mountain Ute Tribe, the Southern Ute Indian Tribe and the Jicarilla Apache Nation; the Tribes located in the Lower Basin are: Chemehuevi Indian Tribe, Cocopah Indian Tribe, Colorado River Indian Tribes, Fort Mojave Indian Tribe and the Quechan Indian Tribe. One Tribe, the Navajo Nation, is located in both the Upper and Lower Basins. The Partnership is a member of the Colorado River Water Users Association and the immediate past Chairman of the Partnership, George Arthur, serves as the current President of the Colorado River Water Users Association in his capacity as representative of the Partnership.

BRIEF DESCRIPTION OF THE TRIBES IN THE SEVEN BASIN STATES AND THEIR WATER  
RIGHTS AND CLAIMS

The Study identified 29 federally recognized tribes ("tribes") in the Colorado River Basin ("Basin") with claims to the use of water from the Basin. To date, there has been recognized, either through federal and state court decrees or congressionally approved tribal water settlements, that tribes in the Basin have the right to divert in excess of 2.9 million acre-feet-per year ("MAF") from the Colorado River and its Upper Basin tributaries, of which the Ten Tribes have the right to divert in excess of 2.3 MAF. Because not all tribes in the Basin or all of the Ten Tribes have had their water rights determined, this amount will increase in the future as final resolution of the tribes rights are achieved. Given that the observed historical long term mean natural flow of the Colorado River is approximately 15 million acre feet per year, it is clear that the tribes' rights constitute a significant quantity of the historic long term mean natural flow and need to be fully addressed by the Basin States and the United States in the ongoing Basin Study.

The Ten Tribes in the Basin use water for multiple purposes including irrigation, recreation, domestic, commercial, wildlife, instream flows, habitat restoration, municipal, industrial, mining, power generation, cultural and religious activities to list a few. The Ten Tribes are working hard to put the water to which they are entitled to use for the benefit of their tribal members but water development on the reserva-

tions has proven to be difficult and slow, frustrated in large part by the federal government's general unwillingness to fund water infrastructure for the benefit of tribes. The Ten Tribes are very concerned that while they struggle to put their water to use, others with far more political clout are relying on unused tribal water supplies and will seek to curtail future tribal water use to protect their own uses. Stated another way, the Ten Tribes are concerned about the impact on other water users when the Ten Tribes' water rights are put to full use for the benefit of tribal members and how that will affect the ability of the Ten Tribes to put their water to use.

#### COMMENTS ON THE STUDY AS IT RELATES TO TRIBAL WATER IN THE BASIN

At the outset of the Study, the Ten Tribes were not represented on the steering committee established for the Study; membership was limited to representatives of the Bureau and the Basin States. Nor did the Ten Tribes feel that they had much of a role in it because they were relegated to participation on sub-teams that were used to develop technical data for the Study. Because it appeared that the Study was to be a decision document which could significantly and adversely impact tribal water rights and tribal usage of water in the future, exclusion from the steering committee became a matter of great concern to the Partnership; this shortcoming and other concerns were raised with the Bureau of Reclamation reminding the Bureau of the United States' trust responsibility to them in the protection of their water and of the tribes' sovereign status in control of their water. The Partnership suggested that the following steps be taken to address their concerns about the Study:

1. Acknowledge and protect the early priority of tribal water rights.
2. Recognize and protect the unused allocation of the tribes' quantified water rights.
3. Recognize and protect the unquantified tribal water rights.
4. Recognize the special status of tribal reserved water rights that is embodied in federal statutes and federal and state case law.
5. Provide a seat on the steering committee for the Partnership.
6. Require that the Colorado River Simulation System model quantify the extent of the reliance of water users on decreed and undecreed rights of tribes not being fully exercised.

In response to the concerns raised by the Partnership, the Bureau, much to its credit, undertook outreach to all of the tribes to explain the purpose of the Study, acknowledge the tribes' water rights and reaffirm the United States' trust responsibility to the tribes. The Bureau assured the Partnership that the Study was not intended to serve as a decision document but was a "first step" in identifying what the potential imbalances of Basin water supply and demand may be in the future and in identifying possible solutions to resolve those imbalances that deserve additional study and analysis. Because of the limited scope of the Study, the matters raised by the Partnership would not be addressed in the "first step" Study but those matters would be appropriate for further study. With that understanding and as a result of the Bureau's outreach efforts, a number of tribes actively cooperated with the Bureau in providing data for the Study.

The outreach proved to be successful and the results are reflected in Appendix C9 of the Study which contains Tribal Water Demand Scenario Quantification.

Although as noted, a number of tribes actively participated in the data collection needed for the Study, the Partnership was still wary that the information in the Study regarding tribal water might be used to their detriment, and recommended that a Disclaimer about the Study be incorporated into it. The import of which is that nothing in the Study is intended to nor shall the Study be construed so as to interpret, diminish or modify the rights of any federally recognized tribe, pursuant to federal and state court decrees, treaties, agreements executive orders, and federal trust responsibility. Further the Disclaimer acknowledges that the Bureau and the Basin States would continue to recognize the entitlement and right of each State and any federally recognized tribe under existing law to use and develop the water of the Colorado River system. Through the cooperative efforts of the Bureau personnel, the Basin States representatives and tribal representatives, a Disclaimer was developed and agreed upon; it is found at ES-22 in the Executive Summary of the Study.

Inclusion of the Disclaimer was an important aspect of the Study for the Ten Tribes and laid the foundation for future work with the Bureau and Basin States in the "next steps" phase of the Study.

REASONS FOR A TRIBAL WATER STUDY AS PART OF THE "NEXT STEPS" PHASE OF THE STUDY THAT THE BUREAU IS UNDERTAKING

Because the Ten Tribes have significant quantities of recognized water rights which will increase as their remaining rights are finally quantified, any study of water in the Basin must reasonably include the Ten Tribes. Further because of their sovereign status and control over use of their water and the United States' trust responsibility regarding protecting the tribes' water resources, tribal involvement will be critical to any solution regarding future supply imbalance in the Basin.

Water allocation and management of tribal water have significant legal and policy considerations and while these issues are identified in the Study, they were not addressed. To correct this shortcoming, at a meeting on the 28th of May in San Diego on the "next steps" phase of the Study, attended by Commissioner Mike Connor and Assistant Secretary for Power and Water, Ann Castle, for the Department of the Interior, the Bureau announced it will be undertaking a Tribal Water Study as the "next steps" phase to address issues surrounding tribal water in the Basin States. This phase of the Study is intended to address tribal water issues in sufficient detail to provide the Bureau, the Basin States and Ten Tribes with the certainty necessary for future River management and planning.

In response to this announcement, the Partnership has created a legal/technical team to work with a counterpart team created by the Bureau to undertake this phase. The "next steps" phase will hopefully include a study capable of evaluating full tribal development, control, and protection of tribal water resources in the Basin.

CONFIRMATION OF THE PARTNERSHIP'S COMMITMENT TO WORK COLLABORATIVELY WITH THE BUREAU OF RECLAMATION AND BASIN STATES TO ADDRESS THE PROJECTED SUPPLY AND DEMAND IMBALANCES IN THE BASIN

The Ten Tribes in the Basin have historically been good neighbors and consider water to be basic to life and are committed to working collaboratively with the Basin States, their Mexican relatives and the United States to initiate actions to implement plans to resolve current and future water imbalances in the Basin.

CONCLUSION

In conclusion, Mr. Chairman, I would be remiss in not acknowledging the yeoman's work performed by Carly Jerla and Pam Adams of the Bureau of Reclamation in reaching out to the tribes and tirelessly advocating on the tribes' behalf and ensuring that the tribes' concerns were addressed. This effort resulted in the tribes actively participating in the Study. Their efforts were fully supported by Commissioner Connor, Assistant Secretary Castle and the Regional Directors of the Lower and Upper Basins, Terry Fulp and Larry Walkoviak. I also want to note the cooperation and to thank the Basin States' representatives in working with the Partnership in developing the Disclaimer contained in the Study. Lastly, I want to thank Cathy Condon and Chuck Lawler from the Partnership for their work in coordinating tribal and Bureau work which resulted in an improved Study and better understanding of tribal water issues for all concerned.

I would be happy to respond to any questions the Committee may have, thank you.

Senator UDALL. Thank you, Mr. Vigil.

In the interest of letting everybody know what we're going to do, we do have a second panel. I do have to leave for a brief period of time at 3:25 to attend another hearing to introduce a nominee to head the Office of Personnel Management from Colorado.

I'm going to ask 5 minutes of questions. I'll turn to Senator Lee and then to Senator Heinrich. I believe Senator Heinrich will continue to Chair the committee while I'm gone for a few minutes.

With that, I want to turn to Mr. Connor.

Respecting the roles that the States have to manage their water resources and their current fiscal constraints, what role, if any, do you expect the Federal Government to play in solving the imbalances projected for the Basin?

Mr. CONNOR. I think the Federal Government is a valued and necessary partner with the 7 basin States and the other stake-

holders in the Basin. I say that we're valued when we work collaboratively with those different stakeholders and certainly the States respecting their interest in the management and allocation of water resources.

The Secretary is the water master in the Lower Colorado River Basin. So we have a certain specific responsibilities in that Basin that we don't have elsewhere in operating those facilities and making sure that there's compliance with the law of the River, the compact, the Treaty with Mexico. Notwithstanding that or in addition to that, we can't carry out those obligations without working very closely and hand in hand with the States.

I think it was Mark Risener in Cadillac Desert who characterized the Colorado River Basin as the most litigated stream system in the world. Probably for a long time it was that. Over the last 10 to 15 years I think through that partnership collaboration with the States and including the other stakeholders in the discussion, I think we've hit upon a series of agreements and progress that we can all feel good about, but can't keep up with the challenges that we face.

So we're going to have to, kind of, double down on our efforts as we move forward.

Senator UDALL. I think it's necessary and mandatory reading for anybody who cares about the Basin to page through Cadillac Desert. I know we don't all agree with everything that's in there. But it certainly was a seminal work.

Mr. Ostler, let me turn to you.

Could you expand on your testimony in describing the different supply and demand limitations between the Upper and Lower Basin States and the possibility of water banking in the Upper Basin could help address these systemic imbalances?

Mr. OSTLER. Yes, Senator Udall.

The Upper Basin States are interested and are now in the process of looking at water banking options that might help solve our imbalances. Water banking may include the concept of conservation during times when you have water so that it's banked and available to help offset storage—or shortage.

It also may include the development of a structure which would allow transfer of high priority water rights to low priority municipalities who need water during droughts so that that can be facilitated easily and without a great deal of questions, so that we can get through droughts and manage through the droughts.

So I think the water banking concept would include both of those types of ideas.

Senator UDALL. I look forward to you elaborating further in any additional written testimony you may provide to the Commission. This, I think, provides real opportunity for us.

Commissioner Connor, let me come back to you.

The study results suggest and Mr. Ostler, you spoke to this and others did as well, that climate change could have a major effect in the amount of water available in the Basin over the next 50 years.

How accurate and dependable are these projections?

Should we expect and plan for even greater decreases in water supply in coming decades?

Then a third question for you. How can States, tribes and local entities prepare for and adapt to such conditions?

You have to answer all of those in a minute and a half.

[Laughter.]

Mr. CONNOR. I appreciate the challenge. It's like managing the Colorado River.

Senator UDALL. That's a good way to put it.

Mr. CONNOR. Overall I think with respect to climate change projections, we already know and there is, without a doubt, strong evidence about the increasing temperatures that have already occurred in the Basin and that are projected to occur over the next 10, 15, 20 and 50 years, the planning period. Those changes in temperature, in and of itself, are causing a change in how water resources flow within the Basin as far as the timing, certainly in the form of that with reduced snow packs and more rainfall events.

So we have incorporated those data points into the planning effort. We know we've got to respond and manage differently.

Where I think the modeling is more wide open as far as interpretation is with respect to future changes in precipitation patterns. There's a wide divergence of views. We've selected and tried to downscale the general circulation model on climate and arrive at a projection that the mean average flows at least are going to be about a 9 percent reduction over the 50-year planning period from where we've been historically.

I would just say right now based on the last 14 years of drought, this period we're 18 percent below our average annual inflows over that period than we have been over the last 100 years. So we're already below that based on the existing drought.

Then I think, Senator Udall, I may have forgotten your last question as part of that.

Senator UDALL. How can States, tribes and local entities prepare and adapt for changes?

Why don't you take that for the record?

Mr. CONNOR. Absolutely.

Senator UDALL. I will stop because I want to recognize Senator Lee and then also Senator Barrasso who has joined us. I want to make sure everybody has a chance to direct some questions.

I'll turn to Senator Lee.

Senator LEE. Thank you, Mr. Chairman.

Why don't we start with you, Commissioner Connor?

The study notes at page 20 of the Executive Summary that not all stakeholders were in agreement with the results, with the findings.

Could you elaborate on this for a minute? I'd like to know what people were not in agreement regarding.

Mr. CONNOR. Thank you, Senator Lee, and yes, I'll be happy to elaborate.

Where there was disagreement that was noted in the Executive Summary is really on our assessment of the options, the proposals that were put forward about how we can attempt to resolve these imbalances.

So there were 150 proposals, options. We did a threshold analysis as to technical feasibility, cost, yield, timing, permit ability, so there was some subjectivity in looking at a threshold analysis of

those options. That's where there was a disagreement amongst some folks assessing that they thought something was more permit-able than maybe the authors did in the study.

So that's where we're at.

Senator LEE. Were there some recommendations that were more controversial than others among the stakeholders?

Mr. CONNOR. Certainly some of the large scale augmentation programs are viewed as more controversial and more questionable as far as feasibility. I think different people have different views as to the feasibility of those efforts.

Senator LEE. OK.

Are those issues identified anywhere in the report, in the study itself, that the nature of the disagreement, where there is the most disagreement and so forth?

Mr. CONNOR. I'm not sure how deeply we've delved down. So if I could answer that for the record.

Senator LEE. OK.

Mr. CONNOR. I'll get you more information about that if it's internal or external to the report we can do that.

Senator LEE. OK. That's fine.

Mr. Ostler, let's turn to you for a minute.

Concerns have been expressed for several years with regard to energy sector water usage in some areas along the Upper Basin, in the Upper Basin in recent years. How would you characterize the significance of this type of water use there?

How extensive is the energy sector water usage compared to other uses?

Mr. OSTLER. It's a critical question that a lot of folks are spending a lot of time thinking about. The States, each State, as they develop their demands, future demands, included their anticipated energy development and its water use. So those estimates according to the States were incorporated into the study that we're talking about.

But it depends on the type of energy development that you assume occurs and the amount of water that that particular development happens to utilize. That's all an unknown. So I think the States included the best information that they had and included plans in their future demands for energy development that they could anticipate.

Senator LEE. Is it your view that there are unique features, unique aspects, of energy sector water usage that are of particular concern or is it more just that people are concerned about the quantity of it or that it's there?

Mr. OSTLER. No.

There are certain types of energy development that maybe use more water than other types. This is new technology. It's changing all the time. The energy companies, I think, are looking for ways to reduce water usage.

We're seeing many that are coming up with proposals that are relatively new that may involve much less water use than what the early estimates were. So yes, it's a matter of controversy. It varies with exactly what is planned on the ground.

Senator LEE. Both at the Basin level and at the State level how effective are our current legal arrangements at addressing this type of usage and the special concerns that arise from it?

Mr. OSTLER. To my knowledge our current legal arrangements are adequate to address energy water usage. They, energy companies, need to obtain water rights through the existing State legal process for getting a water rights permit. So that's the way that it's done now. That's the way we expect it to be done in the future.

Senator LEE. OK.

Mr. OSTLER. They will have to acquire those by paying for them if they don't have themselves.

Senator LEE. Finally are there any particular near term priorities for Federal action that you would recommend to this subcommittee?

Near term priorities relating to water usage?

Anything arising out of this study that you would recommend to this subcommittee that we look at?

Mr. OSTLER. I think the States will continue to look to Reclamation for research and technical guidance on various mechanisms that we can use to improve conservation and operations.

I think the availability of funding to be able to do studies such as this was extremely helpful and important through the WaterSMART program.

Those are immediate things, I think, that we're utilizing and looking at.

Senator LEE. OK. Thank you, Mr. Ostler.

I see my time is expired.

Chairman, thank you.

Senator HEINRICH [presiding]. Thank you, Senator Lee.

Commissioner Connor, in the study water transfers and water banking were found to be one of the most cost effective and quickest ways to address the imbalance between supply and demand in the Basin. In fact, water transfers, exchanges and banking are predicted to cost somewhere between \$250 and \$750 per acre foot per year and could be implemented in as little as 5 years.

Could you talk a little bit in some more detail about why water conservation forbearance banking exchanges are relatively much more cost effective compared to some of the other options that were explored in the study?

Mr. CONNOR. I think overall, you know, it's water transfers and banking arrangements can be put into place without large infrastructure or new infrastructure developments. So, once again, I think, you know, through the institutional arrangements that can be created from—even where there's low cost investments for the agricultural sector say to make investments, conserve water, so that they can be a player in the water transfer and banking situations. Those are just more easily permitted, easily arranged and I think provide flexibility amongst water users to get water to those who need it and to allow for adjustments by those who have senior rights.

So it's just the ease, timing, permit and the low dollar with respect to initial investments, I think, that make it much more cost effective.

Senator HEINRICH. Thank you.



Mr. Vigil, I wanted to ask you, Chairman Vigil, as Water Administrator for the Jicarilla Apache Nation you participated in the San Juan River Basin Recovery Implementation program. It's been held up as a model on how to recover endangered species.

Can you talk a little bit about that experience and that recovery program? What lessons we might learn in some of these other basins where we're trying to balance the needs of productive water use while conserving our fish and wildlife?

Mr. VIGIL. Sure, Senator Heinrich.

Jicarilla Apache Nation has been a participant of that particular recovery program project for numerous years. One of the things that, you know, I have been back to DC for the last 3 years to lobby for the continued funding of that particular project. The success of that project, especially, because I think there was over 2,000 water projects that are related to the recovery program without, I think, any litigation at all which is pretty amazing that, you know, tribes, municipalities, State governments and the Federal Government can work together.

I think it's been the model that it can work. Hopefully, you know, you know, we can use that as a model, you know, for this next steps of the Basin study. We really appreciate Mike Connor and Assistant Secretary Castle's commitment to a separate tribal water study.

Because of the experience that we've had through programs like the recovery program, you know, we hope to take that knowledge and that experience that we have, you know, for that collaborative process as well.

Senator HEINRICH. Thank you, Chairman Vigil. Thanks for your work on that because it really is something we're hoping to learn from.

Commissioner Connor, I wanted a follow up question.

Water issues are often discussed as a conflict between diverting water for economic development or leaving water in stream for non-economic or environmental purposes. But in fact, high flows are critical for many rural economies that rely on recreation jobs in economic development.

In New Mexico alone, Colorado River related recreation is responsible for over 17,000 jobs and more than \$1.2 billion in direct spending. When you consider river management decisions, how do you find that balance between the needs of businesses that rely on divergence and those businesses that rely on robust in stream flows?

Mr. CONNOR. All of those water uses and values are absolutely critical. The water that is diverted to sustain the economies that have grown up around that from the Ag sector and also for M and I purposes as well as the ecological flows that are important for the environmental considerations, but also the recreational based economies.

So I think we are looking to, quite frankly, stretch the limited water supplies that are out there in an attempt to best balance those needs, as you said. It's one of those where we want to work with the affected communities. We want to make water uses as efficient as possible. We want to create buffers so that when there are times of plenty, we've got reserve water supplies that can be

used whether it is to facilitate the environmental and ecological flows or whether it's to provide water during times of drought to those needed to sustain their agricultural livelihoods.

So it's more flexibility in the system. It's more efficiency that we've got to employ to try and sustain all those different uses.

Senator HEINRICH. Thank you, chairman or thank you, Commissioner Connor.

I want to thank all of our panel for being here today because this is the beginning of something not the end. I appreciate your participation.

I want to turn the gavel over to Senator Lee. He is going to chair while Senator Barrasso pursues some of his questions.

Senator BARRASSO. Thank you, Mr. Chairman.

Commissioner Connor, on June 6 our Senate Energy Committee had an oversight hearing reviewing the activities of the programs of the Department of the Interior. Secretary Jewell, in written testimony, addressed the Colorado River Basin Water Supply and Demand study.

She said that she is, "committed to continuing to work with our stakeholders to assess the implications of water shortages to develop flexible operational plans that account for expected periods of drought and support projects that conserve water and improve the efficiency of water delivery infrastructure."

I find this commitment very helpful. I think it fails to recognize that creating additional water storages, to me and to many others who live in the West, an obvious part of the solution to addressing the imbalance between supply and demand which the study projects will, you know, be greater than 3.2 million acre feet by the year 2060. So I don't believe that you or any of the other witnesses on the panel believe that conservation and implementing projects to improve delivery efficiency are going to be able to be sufficient to close this gap.

So what is your understanding of the Department of the Interior's position about increasing reservoir storage capacity in the Colorado River Basin?

Mr. CONNOR. It is one of the tools that in a whole portfolio of actions, I think, needs to be looked at and employed as part of the mix if we're going to address this imbalance.

So I would note that we have brought online additional storage projects in the Animas River Basin. Completed Lake Nighthorse in Ridges Basin Dam in the 2010 time period.

We completed a regulating reservoir on the Lower Colorado River.

I think a lot of the actions taken on the Colorado River to the 2007 coordinated operations and shortage agreement created a mechanism to create intentionally created surplus which is water, additional water stored in Lake Mead which will delay and forestall in the way the potential shortages in the Lower Colorado River Basin.

The Minute 319 agreement with Mexico is part of that mix too.

All told, we've got a million acre feet of additional water in an existing reservoir on Lake Mead right now because of those actions. So we want to enhance storage in our existing facilities. We recognize the need for additional facilities both above ground and below

ground to try and address what I spoke of with Senator Heinrich which is there is going to be more extremes in our weather events. That's one of the things we've got to take advantage of those really high flow years.

Senator BARRASSO. If I could then ask you as well as Ms. Trujillo, it's commonly understood that the lower division States are using their entire basic apportionments as provided by Article Three, Section A of the Colorado River Compact. So given the fact, what are the most viable sources of supply to meet the future water demand imbalances in Arizona, California and Nevada that have already been identified in this December 2012 study?

What do you see as that?

Mr. CONNOR. I certainly think there's more room for conservation and mechanisms to enhance water transfers by willing participants in that effort. I, once again, it's not the whole solution, but I think there is definitely more room to employ that mechanism.

I think there's water supply enhancement strategies in Southern California. I know they brought on their first desalinization facility which I think has been fully permitted and prepared to break ground.

So I see a mix of those items with the regulating reservoir on the lower Colorado River. We're operating more efficiently to capture water to be able to make that available for water users.

Senator BARRASSO. Ms. Trujillo, would you mind commenting as well?

Ms. TRUJILLO. I think that was a good list to start with.

In addition to that, you know, between the States we'll continue to work on additional agreements for water banking or water sharing.

We will work to explore new technologies. The Bureau of Reclamation's desalinization research facilities are a good example to expand use of brackish water, additional supplies.

Then we are looking on the demand side as well to be able to make sure we're efficiently using everything we have and conserving more, if we can.

Senator BARRASSO. Thanks.

Commissioner Connor, just kind of given the realities of the Federal budget, the economic situation in the Southwest and Intermountain West, how can some of the projects to provide additional water supplies best be financed and funded?

Any insights you could share or offer to the committee?

Mr. CONNOR. I think I appreciate you raising that point because I think it's the reality of the times that we live in that we can be a partner, a facilitator and we can strategically invest modest resources from the Federal level.

I'll give you an example with the Yuma desalting plant. We initiated a trial run 2 years ago, 18 months. To really see if we could cost effectively operate that facility to produce water in the Basin.

The trial run was a success. We invested dollars as did 3 entities, municipal entities, Metropolitan Water District, Central Arizona Project and Southern Nevada Water Authority. We produced 30,000 acre feet of water at about \$300 per acre foot.

So we've got to partner up in those types of investments. We've got to figure out long term financing arrangements for the local en-

tities that will, at the end of the day, need to finance most of the new development and infrastructure.

Senator BARRASSO. Thanks, Commissioner Connor.

Thank you, Mr. Chairman.

Senator LEE [presiding]. I want to thank our panelists. We appreciate your testimony today.

We're going to go ahead and gavel out now prior to our second panel beginning its round of testimony so that we can await the return of my cousin from Colorado, Senator Udall. Thank you.

We'll stand in recess.

[RECESS]

Senator UDALL [presiding]. The Subcommittee on Water and Power will come to order. Thank you all for your patience and understanding as we juggle a busy afternoon here in the Senate.

I hear the subcommittee set a new standard in my absence. Senator Lee helmed the committee which I think is very appropriate since this has nothing to do with partisanship or political parties. This has to do with protecting the health of the river on which we all depend.

I also feel comfortable, I should confess, with Senator Lee. Some of you may know he's a cousin. It's been said in the West the Lees are related to everyone. The Udalls are related to everybody. Senator Lee and Senator Udall are related.

But be that as it may, we have a great second panel here.

Ms. Hawes, why don't I turn to you?

You're the Colorado River Program Director of the Nature Conservancy from Boulder, Colorado, one of the Coloradans I mentioned that was here to join us.

So the Floor is yours for 5 minutes. We look forward to your testimony.

**STATEMENT OF TAYLOR E. C. HAWES, COLORADO RIVER  
PROGRAM DIRECTOR, THE NATURE CONSERVANCY**

Ms. HAWES. Thank you, Chairman Udall for the opportunity to testify today. I'm the Colorado River Program Director for The Nature Conservancy. Our work spans all 7 basin States and into Mexico. I'm also one of the co-chairs of the Healthy Flows Workgroup.

My testimony today addresses 3 topics.

One, the importance of the Colorado River system's ecological and recreational values.

A few of the shortfalls in the study but also potential remedies going forward.

The scope of work for the Healthy Flows Workgroup for the next 6 months.

Since you've already heard quite a bit today about the results of the Basin study and what's at stake I won't spend more time repeating that. However, what you haven't heard much about is what's at stake relative to our river's health and to our recreational economy.

The Colorado River boasts more than 30 fish species found nowhere else in the world. Yet 50 percent of our native fish in the Basin have either gone extinct or are considered vulnerable. The river, as most people know, no longer reaches the sea and some of its headwater tributaries run dry on a seasonal basis.

At the same time the river system still provides habitat for the much prized Colorado River Cutthroat Trout and is a draw for visitors from around the world due to its unparalleled beauty and recreational opportunities. The Basin features a \$26 billion recreational economy. There are ten national park units including the Grand Canyon as the Basin's centerpiece. Rafting throughout the region is a major industry. Anglers come from around the world to fish both headwaters and our gold medal fisheries.

More than 5 million adults visit the region each year as tourists supporting approximately 234 thousand jobs and generating more than \$10 billion annually in wages and earnings. Unfortunately the study showed that under all portfolios or solution sets flow related values and resources would likely be negatively affected in the future.

So while the Basin study's consideration of flows was ground breaking in many regards. The study was, in large part, limited by a couple of factors.

Reclamation's water supply study, I'm sorry, water supply model that was used to perform the analysis, known as CRSS, was designed to manage reservoirs and operations along with those reservoirs. It was not designed to look at healthy flows or track healthy flows. Consequently these healthy flow needs were left out of the study.

Another shortfall was that the study was primarily focused on finding solutions to meet consumptive water supply needs. While these are very important there was no mention or assessment of healthy flow needs and solutions associated with those.

The conservation community hopes to remedy some of these shortfalls in the next phase.

First, The Conservancy is already working with a broad cross section of water interests to explore ways to improve CRSS or create new management tools that will allow us to evaluate solutions for both our water users and our rivers. We are doing this with a grant through the Landscape Conservation Cooperative.

Second, in my written testimony I provided several examples of solutions that have been developed around the Basin that meet the needs of people while also benefiting the river. Such solutions are feasible, cost effective, more durable, have buy-in and are more sustainable.

As we move forward water banking, a mechanism we've talked about here. It's one that facilitates the temporary movement of water from agriculture to cities and to the environment through voluntary agreements shows great promise as a way to, not only meet the needs of people, but also our rivers.

The workgroup will be undertaking several tasks in the coming months. Very simply stated we will be seeking an agreement on which rivers are the most important from an ecological, for maintaining key ecological and recreational attributes and exploring ways to protect these rivers.

This workgroup will also be seeking to understand how hydropower will be affected as that's part of one of the flow aspects and looking for solutions that might affect those resources.

We will be preparing a report by the end of 2013 that summarizes this information and proposes phase two activities. It's impor-

tant to remember and others have said this here today that the study is a means to an end. Our mutual goal is finding solutions. That's where we head next.

In conclusion, the future will not look like the past as demands will continue to increase and supplies are expected to decrease. We are at a crossroads in the Colorado River's history as we—and we must all pull together to develop and implement sustainable solutions.

Support from this committee and Congress will be critical to our success. The conservation community strongly supports continued funding of WaterSMART, landscape conservation cooperative programs as well as Title 16 funding.

These programs provide vital assistance to facilitate urban and agricultural water conservation programs as well as environmental solutions. It's imperative to the success of our workgroup that the other two workgroups also produce real savings in their efforts. These efforts must be integrated for us to succeed.

In addition it's important for this body to continue its oversight with regard to the next steps in search of financially prudent, realistic and timely solutions to the imbalances in the Basin and the need to protect these important ecological and recreational values.

Thank you for the opportunity to provide testimony. I'll be happy to answer questions when the time is right.

[The prepared statement of Ms. Hawes follows:]

PREPARED STATEMENT OF TAYLOR E. C. HAWES, COLORADO RIVER PROGRAM  
DIRECTOR, THE NATURE CONSERVANCY

Thank you, Chairman Schatz, Ranking Member Lee and Subcommittee members, for the opportunity to testify on the Bureau of Reclamation's Colorado River Basin Water Supply and Demand Study. I am honored to speak to you today about the Colorado River and how we can plan for its future to ensure it can meet the many demands it faces, including providing water for cities, agriculture, industry, environmental and recreational needs. I am the Colorado River Program Director for the Nature Conservancy. The Conservancy's Colorado River Program spans all seven Basin states and Mexico. The Conservancy seeks to find solutions for our rivers while also meeting the needs of people. I am one of the co-chairs of the Environmental and Recreational Flows Workgroup and will be co-chairing that committee with representatives from the State of Colorado and the Bureau of Reclamation.

The Nature Conservancy is a non-profit conservation organization founded in 1951 whose mission is "to conserve the lands and waters on which all life depends." The Nature Conservancy puts great emphasis on solutions and partnerships, and we rely heavily on science in deciding our direction, focus and priorities. Our staff lives and works in hundreds of communities across the U.S. and around the world. They are supported by almost a million members and by state Boards of Trustees made up of local leaders in conservation, business, agriculture and ranching, academia and philanthropy.

This testimony addresses three topics:

- The importance of the Colorado River system's environmental and recreational values and why it is necessary and possible to find solutions for the Basin that meet the needs of people and nature.
- A few of the long-term needs and opportunities coming out of the study.
- The scope of work for the Environmental and Recreational Flows workgroup over the next six months or so.

Before I delve into the details, I want to acknowledge the leadership of the Bureau of Reclamation in the Colorado River Basin. As we all know, water in the West is contentious, but in the case of the Colorado River Basin, Reclamation has successfully brought states and other water interests together to work towards solutions.

The Nature Conservancy, along with many partner conservation organizations, has worked closely with the Study team, the seven Basin states and Reclamation to inform the Basin Study, serving on technical teams and providing comments on

drafts. The Study found that the combination of increasing demand and dwindling supply, threatens our communities, industry, agriculture, environment and recreational economy unless we take steps now to change our current course. Without healthy rivers, the region's economic vitality and its rich natural heritage are at risk. Drought sets the stage for conflict between water users. But the Basin Study seeks a path where municipalities and the agricultural and environmental communities can find practical solutions to the water supply and demand challenge. We look forward to working with Reclamation, the seven States and other partners as we prepare for a future in the Colorado River Basin that sustains agriculture, allows cities to grow and protects our iconic rivers.

#### THE COLORADO RIVER BASIN'S SIGNIFICANT ECOLOGICAL AND RECREATIONAL VALUES

The Colorado River boasts more than thirty fish species found nowhere else in the world. However, fifty percent of all native fish species in the Basin have either gone extinct or are considered vulnerable. The River no longer reaches the sea and some of its smaller headwater tributaries run dry on a seasonal basis. Dramatic changes in the river's flow regime have facilitated the dominance of invasive plant species, such as tamarisk and Russian olive, which creates poor riverside habitat and uses more water than native vegetation due to its spread up on to the benches above the river. At the same time, the river system still provides habitat for the much prized Colorado River Cutthroat Trout, and the Basin's beautiful rivers, with their dramatic cottonwood galleries, draw birds and visitors from far and wide.

The Basin features a \$26 billion recreational economy, much of which revolves around rivers. There are 10 National Park units, including the Grand Canyon as the Basin's centerpiece, as well as other parks and river reaches drawing hundreds of thousands of visitors annually. There are major rafting enterprises in Wyoming, Colorado, Utah, and New Mexico. Anglers come from around the world to fish both headwaters streams and gold medal trout fisheries in larger tributaries. World-class ski resorts in the region, which rely on snowmaking, support thousands of jobs. Finally, there are many who cannot think of a better vacation than a week on Lake Powell. More than five million adults visit the region for recreational excursions, supporting approximately 234,000 jobs in Arizona, Colorado, Nevada, New Mexico, Utah and Wyoming and generating more than \$10 billion annually in wages and earnings. Unfortunately, the Study showed that under all portfolios (solution sets), flow related values and resources would likely be negatively impacted in the future.

The conservation organizations participated in the Study to ensure that it considered healthy river flows at the same time that it evaluated the future needs of agriculture and cities so that stakeholders could simultaneously develop a long term plan to meet the varied needs in and outside of the Basin. The conservation organizations' vision was coordinated development and management of the River and its tributaries, in order to optimize economic and social welfare without compromising the health of the river itself. The next steps will involve tackling these issues at the Basin level. Recent examples in the Basin—two of which I highlight below—have proven that this kind of approach is possible, but its implementation requires political will and leadership.

While the Basin Study is considering basin-wide solutions, our communities must also be creative in finding local solutions. Smaller scale projects in the Basin demonstrate that the needs of people and nature do not have to be mutually exclusive. For example, consider the San Pedro River. It starts in Mexico and flows north into Arizona near the City of Sierra Vista. The region includes two significant national assets: a major U.S. intelligence and communications testing installation at the Army's Fort Huachuca and the BLM's San Pedro Riparian National Conservation Area. It provides critical riparian habitat to millions of migratory birds, many vulnerable animal species and an endangered aquatic plant. The combination of prolonged drought, increasing human water demands, and other factors have reduced the river's flows in many locations, which has adversely affected wildlife and fish as well as the long-term reliability of water supplies for area residents.

Finding a solution for the San Pedro started with good science and a better understanding of the river. Every June, the Conservancy works with more than 100 community members in the U.S. and Mexico to map over 270 miles of the river and its tributaries to define the extent of surface water, specifically, where the river continues to flow during the very hottest and driest time of the year. We then developed a computer simulation model with our local, State and federal partners to better understand underground groundwater flows in the aquifer that help sustain the river. Using this information, we were able to identify the best locations for groundwater recharge projects that enhance stream flows in the San Pedro by improving the aquifer where it is needed the most. In partnership with the Department of De-

fense, the Conservancy has acquired key lands from willing sellers and is now designing aquifer recharge projects in conjunction with our partners, including Cochise County, local developers, private foundations and Natural Resource Conservation Districts. By combining private and public dollars to concurrently meet both the water needs of people and nature, we developed innovative new technologies and infrastructure solutions to address what were seemingly unsolvable water shortage issues. That is the future we see for the arid West and its rivers: collaboration between private and public interests, development of smart science, technical tools, and infrastructure; and a commitment to simultaneously address the water needs of all water sectors through informed decision-making. Water issues do not have to be focused on conflict.

#### OPPORTUNITIES GOING FORWARD

The SECURE Water Act directed Reclamation to perform basin studies that considered risks to a number of resource values. For the first time ever, SECURE directed consideration of water-dependent recreation, fish and wildlife habitat and “flow and water-dependent ecological resiliency” on a par with Reclamation’s ability to continue water deliveries to traditional agricultural, urban and hydropower beneficiaries. §9503(b)(3). The Colorado River Basin Study was the first major effort of Reclamation and the States to look at flow and water-dependent ecological resources across the Basin. As a result,

The Study recognized the importance of considering river flows to support flow and water dependent ecological systems, power generation, and recreation, through its adoption of metrics used to approximate the performance of these resources, the inclusion of an Enhanced Environment water demand scenario, and the inclusion of an Upper Basin water bank of which the objective specifically includes improving the performance of ecological and recreational resources. [Chapter 10]

While this level of consideration of flows was ground breaking, the Study was, in large part, limited by the water supply model used to perform the study. Reclamation’s basin-wide model, known as Colorado River Simulation System (CRSS), was designed to manage water supply and reservoir operations. It was not designed to track environmental and recreational flow needs or develop solutions to protect or enhance those values. In other words, the model cannot tell us whether flow needs are being met at key locations, because it was not designed to assess flows. Consequently, many key flow needs and solutions were left out of the Study.

Another shortfall was that the Study was focused on identifying solutions to meet consumptive water supply needs. It was not aimed at developing solutions to meet ecological or recreational flow needs. Therefore, with a few exceptions, the Study’s performance measures were not set up to guide the selection of water management actions to meet flow needs. Moreover, many flow needs and solutions were left out of the Basin Study because CRSS was unable to assess them adequately. Without direct linkages between environmental flow needs and water management actions to meet those needs, the Basin Study could not develop flow-related solutions as it did for consumptive water needs. Such disconnects made it difficult to prioritize solutions that meet multiple water needs as described in the San Pedro example.

In the next phases of the Study, parties will be working to craft solutions to meet environmental and recreational flow needs in Basin communities, along with meeting consumptive water needs. The Basin Study will serve as the platform to discuss such long-term solutions that support not only communities, but the amenities everyone associates with the West, including its rivers. The Basin Study, as others have said, is also a “call to action” because it shows that the water supply and demand imbalance for traditional water users, including irrigators and cities, is significant. What is exciting about the Basin Study is that it establishes a dialogue focused on finding feasible, financially prudent solutions for cities, agriculture, industry, recreation and the environment. We ask Congress to follow through on the promise of the Basin Study by fully supporting the agencies, programs and stakeholders that are working on finding solutions to the challenge of managing such a critical river system to the West.

Looking to the past, we can see that anything is possible with political will. For example, the Upper Colorado and San Juan Rivers Endangered Fish Recovery programs have shown that it is possible to meet the needs of endangered fish while also allowing continued consumptive water use. Specifically, the Upper Colorado River Recovery Program has found solutions that work, such as expanding Elkhead Reservoir, a small reservoir in northwest Colorado. The expanded capacity can be shared among a power plant, rural community, agricultural needs, and flows for the



endangered fish. The project sailed through permitting, because it was a true model of collaboration with multiple benefits.

Another example is the recent agreement between the United States and Mexico that restores water to the Colorado River Delta while increasing water supply reliability for communities in both countries. In the past, the international boundary stood in the way of traditional approaches to restoring healthy river flows. When the Colorado River no longer reached the sea and habitat was lost in the delta, many decried Colorado River management as a failure. But water managers from both countries were able to overcome the challenge of the border by creating benefits for water users on both sides of the border. Flows for the environment will be created through cooperation between the United States and Mexico, as well as through private sector contributions. Water will help restore healthy habitat in the delta, water conservation will shore up supplies and both countries will benefit during wet periods and share the pain of cutbacks during drought. While these negotiations were arduous, and the agreement is a pilot planned to expire in five years, the benefits are expected to motivate both countries to negotiate for a successor agreement. Stakeholder processes are not quick, but they often result in the best and most durable solutions that satisfy multiple interest groups.

Additionally, river stewardship tools are necessary for the future as the region becomes more arid. As discussed above, the current model (CRSS) that we use to manage the Colorado River does not allow us “see” innovative solutions that meet multiple purposes. Through a Landscape Conservation Cooperative grant, the Conservancy is working with a broad cross-section of water users, federal agencies, tribes, local communities and other environmental organizations to explore ways to improve the existing model and create new management tools that will better allow us to evaluate solutions for both water users and rivers.

#### ENVIRONMENTAL AND RECREATIONAL FLOWS WORK GROUP SCOPE OF WORK

The Environmental and Recreational Flows workgroup, with representatives from a broad cross-section of environmental, recreational, urban, and state interests, will undertake several tasks in the coming months. While the scope of work will be finalized next week at our first in-person meeting, we will be seeking agreement on which rivers are most important for maintaining key ecological and recreational attributes, what is the role of flows in maintaining those rivers, what are the best tools to protect those rivers and related attributes, and whether additional data is needed to help us develop solutions. As mentioned above, we need 21st Century management tools that allow us to “see” opportunities for river management that protect the river’s health while meeting the needs of people. Therefore, we will consider and hopefully integrate The Nature Conservancy’s assessment of the model into the recommendations of this group for the subsequent phase of work. This workgroup will also seek to understand how hydropower might be affected in the future and possible solutions for protecting those resources.

Second, we will identify locations on the priority rivers identified through this process where opportunities exist to provide environmental and recreational flows. If opportunities exist that have broad support, we will focus on those opportunities first. Finally, we will prepare a report by the end of 2013 that summarizes this information and proposes Phase 2 activities to be conducted in 2014.

#### CONCLUSION

The Basin Study has given us a glimpse into several possible future paths. The future will not look like the past as demands will continue to increase and supplies are expected to decrease. We need to be honest with our communities. We all have a role in creating a sustainable future for ourselves and this River system. To ensure a legacy of vibrant communities, state of the art urban and agricultural conservation, and healthy rivers, we must foster a water stewardship ethic that extends to our rivers. We are at a critical juncture in the Colorado River’s history—we must all pull together to develop and implement sustainable solutions.

Finally, let Australia be a cautionary tale for why water imbalance projections should be a call to action. It was not prepared for the extreme dry conditions it has experienced. Australia was just beginning to plan for a 6% reduction in supplies when they experienced a 38% reduction. It is adjusting to a new normal that has forced dramatic changes in how it manages water for all uses. We can learn from this experience and create a better, less contentious future for the Colorado River and for everyone and everything that depends on this iconic river.

Support from this committee and Congress will be critical to our success. The conservation community strongly supports continued funding of WaterSMART and Landscape Conservation Cooperative programs. Both of these programs provide crit-

ical assistance to facilitate urban and agricultural water conservation projects and environmental solutions. Water conservation in all sectors will be crucial for meeting water needs in the future, both for our urban and rural communities, and for the health of the basin's rivers.

It is imperative to the success of the Environmental and Recreational Flows Workgroup that both the Agricultural and Urban Conservation workgroups produce real water savings. All these efforts must be integrated for us to succeed. In addition, it is important for this body to continue its oversight with regard to the next steps in the search for financially prudent, realistic and timely solutions to the imbalances in the Basin and the need to protect its important ecological and recreation values. The SECURE Water Act established a process where Basin Studies are the first step, followed by recommended solutions and feasibility studies for their implementation. The Colorado River Basin Study was ground-breaking as well as a call to action. The Nature Conservancy looks forward to working with our partners and the Congress to identify and implement solutions.

Thank you for the opportunity to provide testimony and to outline next steps on the Colorado River Basin Study. I would be happy to answer your questions.

Senator UDALL. Thank you, Ms. Hawes.

We've been joined by Kathleen Ferris. She's the Executive Director of the Arizona Municipal Water Users Association.

Ms. Ferris, we look forward to your testimony. Thank you for being here.

**STATEMENT OF KATHLEEN FERRIS, EXECUTIVE DIRECTOR,  
ARIZONA MUNICIPAL WATER USERS ASSOCIATION**

Ms. FERRIS. Senator Udall—OK you see how new I am at this.

Senator UDALL. You're doing great.

Ms. FERRIS. Thank you. My apologies for taking a needed break.

Senator UDALL. That was more than appropriate. No apologies necessary.

Ms. FERRIS. OK. Thank you.

As you heard, as you said, I'm Kathleen Ferris, Executive Director of the Arizona Municipal Water Users Association. I'm one of the Chairs of the Municipal and Industrial Workgroup. So today I'm going to talk to you about the workgroup and about the role of municipal conservation and reuse in solving water imbalances based on the Arizona experience.

Since 1980 Arizona has pursued a comprehensive approach to water management. We've implemented many programs to reduce consumption and increase efficiency. We've treated and reused millions of acre feet of waste water for many beneficial uses.

We've stored underground over 8 million acre feet of water for use in times of drought. We prohibit new residential subdivisions that cannot demonstrate a 100-year assured water supply.

The AMWUA members including the city of Phoenix have been leaders in progressive water management. Our success can be measured by the fact that while the population of the AMWUA cities has grown by 157 percent since 1980 to more than 3.2 million, water use has increased by only 87 percent.

State wide our numbers also tell a similar story. Arizona's population has increased a whopping 470 percent since 1957. But total water use today is virtually the same, virtually the same, as it was nearly a half century ago. We've done all this without sacrificing our quality of life or our economic prosperity.

So Arizona's experience demonstrates that conservation and reuse are absolutely essential. But I need to offer a word of caution

here about the role that they can play in solving all of the Colorado River imbalances.

To estimate future demand for Colorado River Reclamation developed 6 scenarios. Then for each scenario a projected amount of conservation was included. It ranged from 500 thousand acre feet to over a million acre feet per year.

The Basin study then assumed that progressively ambitious, best management practices or BMPs could reduce Colorado River demands by another one million acre feet annually by 2060. So that would be so great. But the study acknowledges that many of the BMPs have already been implemented throughout the study area. It also goes on to make clear and I quote that, "Its conservation assumptions do not necessarily reflect realistic or achievable local conservation goals.

So here is where the M and I workgroup comes in. Our role is to ground truth the study.

We will quantify conservation and reuse savings to date within the study area.

We will document successful conservation and reuse programs already in place.

We will explore the potential for expanding those programs to other parts of the study area.

Finally, after gathering these facts the workgroup will analyze the potential for conservation and reuse to reduce Colorado River water demands.

So it's tempting. I know it's very tempting to look to conservation and reuse as the silver bullet to Colorado River imbalances. Make no mistake they're absolutely necessary to stretch our water supplies.

But Arizonans have learned that we will also need to augment our water supplies and employ other management strategies to meet our growing demands.

My 36 years as a water professional lead me to believe that a similar comprehensive approach is going to be necessary for solving the Colorado River imbalances. I think we have to be unafraid to seek the truth about what will and will not work so that the solutions we forge will have real and lasting results. We owe that to the Colorado River and to our citizens.

Thank you very much for your interest in this issue.

[The prepared statement of Ms. Ferris follows:]

PREPARED STATEMENT OF KATHLEEN FERRIS, EXECUTIVE DIRECTOR, ARIZONA  
MUNICIPAL WATER USERS ASSOCIATION

Chairman Schatz and members of the Subcommittee, I am Kathleen Ferris, Executive Director of the Arizona Municipal Water Users Association (AMWUA). Thank you for the opportunity to testify before the Subcommittee on the Colorado River Basin Water Supply and Demand Study (Basin Study).

AMWUA is a non-profit association of municipal water providers in the Phoenix metropolitan area. Our members are the Cities of Avondale, Chandler, Glendale, Goodyear, Mesa, Peoria, Phoenix, Scottsdale and Tempe, and the Town of Gilbert. Collectively, the AMWUA members provide water to over 3.2 million people, more than fifty percent of Arizona's population. Since 1969, AMWUA has advocated for responsible water stewardship that supports economic prosperity and safeguards Arizona's water supplies for future generations.

I am also one of the Chairs of the Municipal and Industrial Conservation and Reuse Workgroup (M&I Workgroup). This Workgroup, comprised of conservation

professionals from the Basin states, Reclamation, and representatives of NGOs, was formed as part of the next steps of the Basin Study.

For the past 36 years, I have devoted my professional career to developing and implementing sound water management policies in Arizona. I was one of the drafters of Arizona's Groundwater Management Act, served as the Director of the Arizona Department of Water Resources, and was legal counsel to AMWUA for 24 years before assuming the position of Executive Director. With that background, I would like to share my views on conservation and reuse as water management tools and their role in solving future imbalances of Colorado River water. I will also discuss the duties of the M&I Workgroup.

#### CONSERVATION AND REUSE IN THE STUDY AREA—THE ARIZONA EXAMPLE

For more than thirty years, conservation and reuse of water have been a way of life in central Arizona. In 1980, Arizona enacted the Groundwater Management Act<sup>1</sup> to "provide a framework for the comprehensive management and regulation of the withdrawal, transportation, use, conservation and conveyance of rights to use groundwater."<sup>2</sup> Prior to 1980, Arizonans had been mining groundwater supplies without regulation to keep up with continually expanding uses. Groundwater mining led to land subsidence, water quality degradation, and costly lawsuits among water users. Finally, after two and a half years of work by a special commission and intense negotiations chaired by Governor Bruce Babbitt, Arizona passed this comprehensive law that is unique in the United States in its far-reaching approach to water management. Hailed in 1986 by the Ford Foundation and the Harvard School of Government as one of the ten most innovative programs in state and local government, Arizona's Groundwater Management Act continues to be one of the nation's most visionary laws for the use and protection of water resources.

The Groundwater Management Act applies to Arizona's most heavily populated areas. These are known as Active Management Areas or AMAs,<sup>3</sup> and encompass approximately 83 percent of the state's population and 57 percent of its water use. Within AMAs, the Act quantifies rights to use groundwater,<sup>4</sup> prohibits new agricultural irrigation,<sup>5</sup> permits new wells to be drilled only in conformance with well-impact standards,<sup>6</sup> and prohibits the development of new residential subdivisions without a proven 100-year assured water supply.<sup>7</sup>

The Act also requires the Arizona Department of Water Resources to develop progressive 10-year management plans for each AMA, designed to achieve a management goal for that AMA.<sup>8</sup> The management goal for the Phoenix, Tucson and Prescott AMAs is safe-yield.<sup>9</sup> Safe-yield is a long-term balance between the amount of groundwater withdrawn in the AMA and the amount of natural and artificial recharge in the AMA.<sup>10</sup> The management plans must contain conservation requirements for all water users in the AMAs.<sup>11</sup> Because these plans provide the blueprint for conservation in most of Arizona, it is important to understand how they are developed and the strategies that have been employed to increase water efficiency in the AMAs.

The management plans are developed using technical advisory committees and multiple levels of public input. In each successive ten-year period, the preparation of the plans provides the opportunity to analyze the effectiveness of water management efforts. Adjustments in strategies and conservation requirements are made, and additional reasonable reductions in water use are specified. In each management period, the Department of Water Resources has included incentives for the efficient use of renewable supplies, provided technical and financial assistance, and revised programs based on new technologies and practices.

Since the First Management Plan was adopted in 1984, the approach to municipal conservation has been refined, evolving in sophistication and flexibility in each subsequent management period, in response to the growing understanding of the complexities of water management issues. In the First Management Plan, one program was applied to all providers. It quickly became apparent, however, that the unique

<sup>1</sup>A.R.S. Title 45, Chapter 2

<sup>2</sup>A.R.S. § 45-401.B

<sup>3</sup>A.R.S. Title 45, Chapter 2, Article 2

<sup>4</sup>A.R.S. Title 45, Chapter 2, Article 5

<sup>5</sup>A.R.S. § 45-452

<sup>6</sup>A.R.S. § 45-598

<sup>7</sup>A.R.S. § 45-576

<sup>8</sup>A.R.S. § 45-563

<sup>9</sup>A.R.S. § 45-562

<sup>10</sup>A.R.S. § 45-561

<sup>11</sup>A.R.S. §§ 45-564 through 45.568.02

characteristics and growth patterns within a provider's service area greatly influence that provider's ability to reduce per capita use.

Today, there are two primary conservation programs for large municipal providers (those serving 250 acre-feet of water or more annually): the base Total Gallons Per Capita per Day (Total GPCD) Program and the Non-Per Capita Conservation Program (NPCCP). In addition to these programs, each provider must limit water system losses to less than 10 percent and meter all service connections, and is subject to mandatory reporting requirements.

Under the Total GPCD Program, a large municipal provider must limit the annual per capita water use within its service area to a specified total GPCD requirement calculated individually for that provider. Total GPCD includes residential, industrial, commercial, and other uses supplied water by the municipal provider. The actual amount of water withdrawn, diverted, or received by the municipal provider in the calendar year determines compliance. Some deliveries of treated wastewater by the municipal provider are excluded from the calculation to encourage the use of reclaimed water.

The alternative Non-Per Capita Conservation Program requires implementation of specific residential and non-residential conservation measures for interior and exterior water use and a water conservation public education program. Conservation measures selected by the provider must be designed to result in water use efficiency equivalent to that assumed in the provider's total GPCD requirement. The NPCCP is a performance-based program with compliance determined by effective implementation of stipulated conservation measures and required water use reductions.

Under municipal conservation programs, facilities and industries that receive municipal water, including landscaped public rights-of-way, turf-related properties and other non-residential customers, also have specific conservation requirements. These requirements include limitations on allowable acreage with turf, limitations on water-intensive landscaping for hotels, annual water allotments for turf, and low water use landscaping in rights-of-ways.

The AMWUA members have responded to the challenges of conserving water. Each member has a dedicated water conservation office and expert staff to assist its community. In addition to limiting water system losses to less than 10 percent, repairing and replacing service meters, and setting rate structures that encourage conservation, the members collectively implement 305 best management practices, including:

- Water-waste and irrigation ordinances
- Residential audits
- High water use notification and assistance
- Rebates for converting from turf to water-efficient landscaping
- Training for landscape professionals
- Water use plan requirements for commercial, industrial, and institutional facilities
- Retrofit programs for low-income residents
- Plumbing codes
- Restrictions on water features
- Extensive outreach and education

These individual efforts have paid great dividends, but AMWUA has also seen the benefit of collaborative regional conservation programs and was the forerunner in those efforts, launching the Regional Water Conservation Program in 1982. Through this program we share conservation information, messaging, training and education. We count our citizens as partners by supplying knowledge that encourages individuals to make real changes that foster stewardship of our resources. Because we pool resources and identify common needs, our efforts have greater visibility, reach, consistency and impact.

Recognizing that between 50 and 70 percent of residential water use in central Arizona occurs outdoors, the Regional Water Conservation Program has focused extensively on developing educational brochures to inspire and assist homeowners to design, install and maintain low-water-use landscapes. We have distributed more than 4 million of these brochures and developed award-winning, interactive websites, helping to popularize the shift to water-efficient landscapes across our region.

Research showed that our customers didn't want to be told to conserve—they wanted to learn how to conserve—so our members also developed the multi-media campaign Water—Use It Wisely. We have devoted more than thirteen years to this campaign, increasing public consciousness and empowering individuals to conserve, and over 400 public and private entities across our country have followed Arizona's

lead. Today, Water—Use It Wisely is the largest water conservation awareness campaign in North America.

Since passage of the Groundwater Management Act, the AMWUA cities have also become leaders in the reuse of wastewater, reclaiming 100 percent of the wastewater produced by their citizens and putting it to beneficial uses such as energy production, turf irrigation, agriculture, environmental restoration, and recharge.<sup>12</sup> The uses of this wastewater are many and varied, but one striking example shows the long-lasting and innovative nature of our reuse efforts.

In 1973, AMWUA negotiated an agreement with Arizona Public Service Company to provide reclaimed wastewater to the Palo Verde Nuclear Generating Station (Palo Verde) for cooling purposes.<sup>13</sup> Located approximately 50 miles west of Phoenix, Palo Verde is the largest nuclear generating station in the western hemisphere, producing 4.0 gwh of energy, and supplying power to the grid for the entire southwestern United States. It is the only nuclear plant not located on a large body of fresh water for cooling purposes, and the only nuclear plant in the world to use recycled wastewater for cooling. The 91st Avenue Wastewater Treatment Plant, operated by the City of Phoenix for Phoenix, Glendale, Mesa, Scottsdale and Tempe, provides up to 80,000 acre-feet of reclaimed wastewater annually to Palo Verde through a dedicated pipeline. The plant itself uses water efficiently, recycling it 25 times for cooling purposes. Unlike other nuclear plants, Palo Verde maintains “zero discharge,” with no liquid waste discharged to rivers, streams or oceans.

The AMWUA members also work with commercial and industrial facilities to create opportunities to recycle process water and advance efficiency and sustainability. Through an innovative partnership, the City of Chandler and Intel built and operate a facility that uses state of the art technology to treat industrial process water from Intel’s semiconductor manufacturing plants to bring it up to drinking water standards. The water is then recharged back into the ground, providing a renewable water supply for the City. Since the beginning of operations, the Chandler Reverse Osmosis Facility has pumped over five billion gallons of recycled water back into the ground, enough water to supply 45,000 households. Intel also uses recycled water in its cooling towers and reclaimed wastewater from a nearby Chandler reclamation facility to irrigate landscaping. This partnership has allowed industrial growth to occur in the City, creating thousands of high-paying jobs, increasing City tax revenues, and boosting the area’s economy, while maintaining a healthy water supply.

Water management innovations in Arizona did not end with passage of the Groundwater Management Act. Since 1980, Arizona has enacted progressive laws prohibiting the use of drinking water in man-made development lakes,<sup>14</sup> requiring water conservation plumbing,<sup>15</sup> and encouraging the underground storage of excess water supplies for use in times of drought.<sup>16</sup>

The impacts of these laws on water use in Arizona have been substantial. Demand for water is flattening, despite the dramatic growth of the region. While the population of the AMWUA cities increased by 157 percent between 1980 and 2010, water use increased by only 87 percent. Individual municipal records are equally impressive. The City of Phoenix is the sixth largest city in the country with more than 1.4 million residents. Between 1980 and 2010, the City’s population increased by 83 percent, yet the City’s total per capita demand increased by only 35 percent and its total water production increased by only 18 percent.

Conservation and reuse efforts outside of the AMAs tell a similar story. Cities in other parts of Arizona have also implemented programs and measures to promote water efficiency, including limits on landscape watering and expansion of turf, tiered rate structures, rebates for low flow appliances, and prohibitions on the use of potable water for golf course irrigation. The numbers are dramatic. Statewide, Arizona’s population has increased by 470 percent since 1957, but total water use is virtually the same today as it was more than a half century ago.

Water is not just about supporting the population, it drives the economy. In Arizona, we have found that we can have water efficiency and a healthy economy. The attached info-graphic shows that our domestic income continued to increase even as water use became more and more efficient.\*

<sup>12</sup>In Arizona, reclaimed wastewater is not groundwater or surface water and the entity that treats the wastewater is free to contract for its disposition. *Arizona Public Service Co. v. Long*, 773 P.2d 988 (1989).

<sup>13</sup>The Agreement was renegotiated in 2010.

<sup>14</sup>A.R.S. Title 45, Chapter 1, Article 3

<sup>15</sup>A.R.S. Title 45, Chapter 1, Article 12

<sup>16</sup>A.R.S. Title 45, Chapter 3.1

\* Graphic has been retained in subcommittee files.

In Arizona, codes, ordinances, pricing, and incentives have led new development to build in efficiency on the front end. Efficient fixtures continue to improve interior water use. Desert-adapted landscaping has gained in popularity. Smart irrigation technology is becoming more common. Clearly, Arizonans embrace conservation and reuse to stretch all of our water supplies to ensure sustainable growth and economic prosperity. We are eager to share our successes with the other Basin states.

#### CONSERVATION AND REUSE IN THE BASIN STUDY

Conservation and reuse are essential to our Colorado River basin economies, but while further implementation of evolving technologies and proven practices can continue to help maximize the use of our existing water supplies, it is doubtful that the projected Colorado River imbalances can be satisfied through conservation and reuse alone.

To estimate the future demand for Colorado River water, Reclamation developed six water demand scenarios. These scenarios include current projected demand, demand based on slow growth or rapid growth, and demand based on enhanced environmental uses. The amount of M&I conservation included in each demand scenario varies, from 478,000 acre-feet for the current projected demand scenario to 1,114,000 acre-feet for the enhanced environment scenario.<sup>17</sup> Reclamation then examined the potential for additional conservation (over and above the amounts estimated in the demand scenarios) by considering three levels of increased conservation “based on assumed levels of reductions and adoption rates” of progressively ambitious best management practices (BMPs).<sup>18</sup> Using this approach, the Study estimates that additional conservation could reduce Colorado River demands by as much as another 1 million acre-feet by 2060.<sup>19</sup> This robust savings figure should be evaluated in light of the following considerations noted in the Basin Study:

- The assumed levels of reductions and adoption rates for best management practices were derived from Colorado and California approaches and applied to the total Study Area demand to result in a Basin-wide estimate of potential savings. “The assumptions were derived for purposes of the Study and do not necessarily reflect realistic or achievable local conservation goals.”<sup>20</sup>
- Many of the BMPs considered in the levels of increased conservation “have already been enacted throughout the Study Area.”<sup>21</sup>
- “The potential M&I conservation measures are assumed to apply to the overall Study Area, but significant differences in potential water savings exist between geographies based on the current level of conservation adoption, commercial and industrial base, and climate.”<sup>22</sup>

These considerations clearly indicate that the 1 million acre-foot figure should not be relied upon too heavily.

Additionally, the Basin Study makes a distinction between conservation savings for “in-Basin” locations, and conservation savings for “out-of-Basin” locations, such as Southern California and Denver.<sup>23</sup> The Study states:

In many of the major urban areas receiving Colorado River water, the overall water supply provided to communities consists of a significant portion of other supplies (other surface supplies, groundwater supplies, reuse, etc.) in addition to Colorado River water. In most of these out-of-Basin areas, the supplies are commingled in the water supply and distribution systems before delivery to the consumer. Because conservation measures are end-use water demand reductions, the water savings result in a net demand reduction. In these areas, the net M&I demand reductions may not result in the same amount of demand reduction for Colorado River water. This is the result of the distributed nature of conservation efforts and the inability of conservation to target one type of supply in regions that have diverse water supply portfolios. . . . Water conservation will reduce the

<sup>17</sup> Colorado River Basin Water Supply and Demand Study, Appendix F9-10, Table F9-4

<sup>18</sup> Id., Appendix F9-6

<sup>19</sup> Id., Appendix F9-11, Table F9-5

<sup>20</sup> Id., Appendix F9-6

<sup>21</sup> Id., Appendix F9-3

<sup>22</sup> Id., Appendix F9-8

<sup>23</sup> While most of Arizona is located within the Colorado River Basin, municipal uses of Colorado River supplied by the Central Arizona Project are more similar to uses in out-of-Basin areas, since central Arizona is located more than 300 miles from the River. Municipal and industrial uses of Central Arizona Project water were treated like out-of-Basin uses for purposes of this Study.

overall demand on these supplies collectively, but is not likely to result in a one-for-one reduction in Colorado River demand.

As the next steps of the Study move forward, it will be important to gain a better understanding of how much Colorado River water can, or cannot, be saved by conservation in out-of-Basin urban areas.

The Basin Study also estimates that greater municipal wastewater reuse could potentially reduce Colorado River demands by 930,000 acre-feet by 2060.<sup>24</sup> The Study points out that, “Given the complexity of regional and local water management decisions, it was simply assumed that increased development of reuse reduces water demands proportionally to the magnitude of supply from Colorado River and non-Colorado River sources.”<sup>25</sup> This assumption and the role of reuse in reducing demands on the River warrant greater exploration.

From my experience with water conservation and reuse in Arizona, I offer the following perspectives. While GPCD rates can be useful in tracking water use trends over time within a service area, such absolute metrics should not be used to judge relative water use efficiencies among different water providers. These metrics cannot take into account geographical differences, such as climate, and differences in development patterns, lot sizes, cultural and socio-economic conditions, and industrial and commercial uses within a provider’s service area, all of which significantly impact water use. There is no industry standard for how per capita use is calculated. A further complicating factor is that providers meter, categorize, and track customer accounts and end uses in dramatically different ways. There is no apples-to-apples approach that is used by all providers. In short, a provider’s progress is best measured in light of the history and future potential within its specific service area.

Efficient water use must also consider the need for viable economic development. Efficiency must allow for uses of water that provide high-paying jobs, increase a city’s tax base, provide goods and services to the nation, and improve overall standards of living.

Conservation and reuse are necessary, desirable, and effective water management tools, but they must be supplemented with other measures. In central Arizona, we have found that a comprehensive approach is necessary. Even as we conserve and reuse, we must also augment our supplies and employ other strategies, such as underground storage of water, to ensure that our water supplies are secure, reliable and sustainable. The same can be said for Colorado River water. We must conserve and reuse Colorado River supplies, but we must be mindful of the limitations of these tools. We must explore all of our options, including augmentation, to ensure a balanced and sustainable approach to this complex issue.

#### DUTIES OF THE M&I WORKGROUP

The M&I Workgroup consists of representatives of all of the Basin states, Reclamation, and several Non-Government Organizations. Carolyn Schaffer, of the Metropolitan Water District in Southern California, and Marc Waage, of Denver Water, serve with me as chairs. We have developed a proposed scope of work for the first phase of the Workgroup’s activities. We intend to quantify conservation and reuse savings to date within the Study Area by gathering and examining more detailed data from existing reports, studies, planning documents and other information sources. We will also document successful conservation and reuse programs that have been implemented in the Study Area and assess the potential to expand these programs to other parts of the Study Area. Ultimately, we will analyze the potential for additional conservation and reuse to help reduce Colorado River water demands.

This is a big undertaking in a short period of time, but we are committed to completing our task. For Arizona, addressing potential Colorado River imbalances is of the utmost importance. For the AMWUA members, it is critical. The Central Arizona Project (CAP), along with Nevada and some Arizona municipal providers on the River, share the lowest priority to Colorado River water in the Lower Basin. In times of shortages, we take the first hit. My members hold contracts to almost 300,000 acre-feet of CAP water, nearly half of the CAP M&I supply. As municipal water providers, we know the necessity of reducing vulnerabilities so that we may continue to provide reliable supplies to our citizens, businesses and industries. We recognize the need to balance competing interests and the value of a healthy River system. We understand the importance of dealing with Colorado River imbalances, just as we have long understood the urgency of managing all of our water resources efficiently.

<sup>24</sup> Id., Appendix F6-3

<sup>25</sup> Id., Appendix F6-2



Arizona and AMWUA appreciate Reclamation's leadership on this crucial issue and look forward to working with Reclamation and the other Basin states to find comprehensive and lasting solutions.

Thank you for your interest in this important issue.

Senator UDALL. Ms. Ferris, thank you for that very insightful commentary. I look forward to directing a couple questions your way when Dr. Waskom concludes his remarks.

The third member of our panel, a fellow Coloradan, is Dr. Reagan Waskom. He's the Director of the Colorado Water Institute, Colorado State University at Fort Collins.

Doctor, welcome. We look forward to your testimony.

**STATEMENT OF REAGAN WASKOM, DIRECTOR, COLORADO  
WATER INSTITUTE, COLORADO STATE UNIVERSITY**

Mr. WASKOM. Thank you, Mr. Chairman.

For the record my name is Reagan Waskom. I serve as the Director of the Colorado Water Institute at Colorado State University. I'm providing my comments today in my role as the co-chair of the Agricultural Conservation Transfers Workgroup of the Basin study.

These comments are my own and they may or may not reflect the comments of my current or my fellow workgroup members.

So my testimony today will focus on the importance of the Colorado River for sustaining agriculture in the Southwest.

I'll talk a little bit about the direction of our workgroup.

Then the challenges inherent in agricultural water conservation, particularly for transfers to other uses.

So as was already mentioned, the Basin study confirms that without further actions we face growing shortages. One of the options that's been explored in the study and has been mentioned today already is the idea of agricultural conservation and transfers. Certainly this is not a new idea. We've been doing this in the Western U.S. for some time now. Hundreds of thousands of acres of previously irrigated lands have already been dried up in the West, to me, growing municipal, industrial and environmental needs.

This trend of transferring agricultural water has real and far reaching implications on our future agricultural productivity and the viability of rural communities.

Agriculture in the Colorado River Basin is driven by irrigation. Roughly two million acres irrigated in the Upper Basin and roughly two million in the Lower representing 15 percent of all U.S. crop receipts and about 13 percent of all livestock in the United States. Much of our winter vegetables as well, I might mention.

So the Basin study estimates that we may be able to capture a million acre feet of water through conservation by the year 2060 to fill the gap. This would be done by implementing a number of measures specifically advance the irrigation scheduling, to have opposite irrigation, on farm irrigation system improvements, controlled environment agriculture conveyance system efficiencies and fallowing of irrigated lands.

So in order to encourage the adoption of these measures two possible implementation strategies have been considered.

The first calls for conservation through incentive based programs. So this would be voluntary conservation, increasing water use efficiency and thereby reducing agricultural demand.

The other approach is voluntary agricultural conservation that will result in conserved water available for transfer to other uses to meet supply demands, if you will.

So as you've heard these basin study workgroups are being set up to dig deeper into the details. I'll be co-chairing the agricultural workgroup with Tina Shields, of the Imperial Irrigation District and Ken Nowak of the Bureau of Reclamation. Our workgroup intends to develop a report that quantifies agricultural conservation and transfer of Colorado River water to date.

So it's been done through this mechanism. We want to document impacts and tradeoffs that have occurred and then determine any future plans for further conservation and transfer activities.

Then estimate what sort of savings can we really expect to get?

What could be transferrable?

Then from that baseline information we want to move forward.

So I think it's important that we be aware that agricultural interests are concerned with the future scenarios that have been identified in the Basin study. I believe that irrigation districts in the Southwest, they appreciate the collaborative effort that's been done to date between Reclamation and the States that has led to the completion of this first step. I think a key overall benefit is that now all the parties can more or less be on the same technical platform. We're on the same page.

However, I do know that many agricultural interests are concerned about virtually every scenario that's been assessed in the Basin study. They all show a loss of irrigated lands as well as those concerned about the quantity of agricultural water that realistically can be conserved.

So once our workgroup has a firmer hold on the number that we think is realistic through conservation savings, I'm hoping the workgroups will spend its time really focusing on the incentives and solutions that we need to meet the gap. Some of that will certainly come from improved infrastructure. Some will come through involuntary transfer mechanisms such as have been mentioned already.

I'm pleased that Reclamation and the 7 States are committed to continued refinement of the Basin study as part of a long term tool for robust planning and implementation. The western irrigated agriculture is really an important component of our food supply. We need to think about that. As a society we need to think about the tradeoffs that are associated with transfer and water that's currently being used to produce our food supply.

Thank you for the opportunity to testify today.

[The prepared statement of Mr. Waskom follows:]

PREPARED STATEMENT OF REAGAN WASKOM, DIRECTOR, COLORADO WATER  
INSTITUTE, COLORADO STATE UNIVERSITY

My name is Reagan Waskom and I serve as the director of the Colorado Water Institute at Colorado State University. The Colorado Water Institute is one of the 54 state water resources research institutes funded through the US Geological Survey and organized under the National Institutes for Water Resources (NIWR), the organization that collectively represents the state water resources research institutes. Our Institute has been working on agricultural water management and Colorado River issues, among many other pressing water problems, since 1965. Currently, we are deeply engaged in dealing with drought and its associated problems such as fire and crop failure in the state of Colorado. For the record, this year I'm

serving as the president of the National Institute for Water Resources and as the president of the Colorado Water Congress, but I am providing comments today solely in my role as a Co-Chair of the Colorado River Water Supply and Demand Basin Study Agricultural Conservation and Transfers Workgroup. My testimony will focus on the importance of the Colorado River for sustaining agriculture in the Southwest, the direction of our workgroup and the many challenges inherent in conserving agricultural water for transfer to other uses.

#### IMPORTANCE OF THE COLORADO RIVER TO THE SOUTHWEST USA

The Colorado River is one of the most important resources in the Southwestern U.S. and it is a critical water resource for the State of Colorado. The Colorado River spans parts of the seven states of Arizona, California, Colorado, New Mexico, Nevada, Utah, and Wyoming (basin States), and it provides: 1) the municipal water supply for more than 30 million people; 2) the irrigation supply for nearly 4 million acres of land; and, 3) hydropower to generate more than 4,200 MW.

Water supply and demand imbalances already exist in some geographic areas in the Basin and these imbalances are projected to increase in both magnitude and spatial extent in the future. The Colorado River system has storage capacity that is greater than 60 million acre-feet, which is approximately four times the average inflow (14.9 maf), and this storage has allowed most demands in the lower Colorado River Basin to be met, even over periods of sustained drought. In the upper Colorado River Basin shortages exist somewhere in the upper basin in most years, due to variability of snowpack and rainfall. However, studies indicate that droughts of greater severity have occurred in the far past and climate experts and scientists suggest that such droughts are likely to occur in the future.

#### NATURE OF COLORADO RIVER BASIN AGRICULTURAL WATER USE

Agriculture in the Colorado River Basin is driven by irrigation, with about two million acres of land irrigated in the Upper Basin (including tributaries and transbasin lands) and another two million in the Lower Basin, representing about 15 percent of all crop receipts and 13 percent of all livestock in the U.S. A wide variety of crops are grown in the basin, including corn, sorghum, wheat, barley, cotton, peanuts, sugarbeets, soybeans, potatoes, lettuce, onions, chilies, alfalfa hay, grass hay, cauliflower, broccoli, carrots, honeydews, cantaloupes, watermelons, grapefruit, oranges, lemons, tangerines, grapes, tomatoes, apples, cherries, apricots, and peaches. Production of sheep, goat, dairy and beef cattle are large contributors to the basin's agricultural output.

California has the greatest number of irrigated acres of the seven states, with its largest user the Imperial Valley, which irrigates almost 500,000 acres. In Colorado, there are approximately 600,000 acres of agricultural lands in the Basin plus another 900,000 acres outside the basin that are partially irrigated with transbasin diversions. The San Juan River (the Colorado River's largest tributary) irrigates nearly 100,000 acres in New Mexico. Nevada does not directly use water from the Colorado River for agriculture; however, in Utah and Wyoming, the Colorado River and its tributaries provide irrigation water for over 500,000 acres.

Previous research indicates that strong support exists among those who live in the western states for keeping land and water in agriculture and limiting water transfers that create adverse impacts on rural communities (Western Governors' Association and Western States Water Council, 2012). Local food and fiber production, protecting open space and wildlife habitat, maintaining agricultural jobs and businesses, and preserving western heritage are among the reasons for ensuring there are adequate land and water resources for agriculture production.

The Colorado Water Institute is currently working with the Water Research Institutes from the six basin states to survey and interview farmers and ranchers who use Colorado River water to determine their preferences for meeting future water shortages. They indicated a strong preference for water conservation and efficiency (77 percent); working towards public policy that supports keeping land and water in agriculture was ranked second highest at 75 percent. Findings from in-depth telephone interviews we conducted in late 2012 with agricultural water users and managers in all seven states suggest that agricultural irrigation efficiency and conservation are major concerns for farmers and ranchers. Yet significant technical, institutional, legal, economic, and social barriers to conservation are seen to exist across the Basin. Some water managers spoke of the technical complexities of efficiency and conservation, wherein the type of crop cultivated and irrigation technology employed shape how much water can be produced by conservation. For many farmers, conserving agricultural water is perceived as potentially harmful to their interests and to their future. Many fear, correctly or not, that under their state's water law,

conservation may reduce their water rights and even subject them to legal abandonment.

#### BACKGROUND ON THE BASIN STUDY

Recently, the Colorado River Basin States (“Basin States”) and the Bureau of Reclamation completed the Colorado River Basin Study (“the Basin Study”), to assess future water supply and demand imbalances over the next 50 years and develop and evaluate opportunities for resolving imbalances. The study has been under development for nearly three years by the U.S. Bureau of Reclamation (Reclamation) and the Basin States, in collaboration with stakeholders throughout the Basin. Reclamation officials have emphasized that this is a planning study; it will not result in any decisions, but will provide the technical foundation for future activities. In addition, the Study explored various options that could be used to reduce the anticipated supply/demand imbalances. A scenario planning approach was used for this study to examine the full range of possible water supply/water demand projections. The Study, a compilation of seven technical reports and two overview documents, is available in its entirety at <http://www.usbr.gov/lc/region/programs/crbstudy/finalreport/index.html>.

The Basin Study’s four different supply scenarios and six different demand scenarios present a broad range of possible imbalances. However, when comparing the median of the six demand scenarios combined with the median of four different water supply scenarios, a Basin-wide imbalance of approximately 3.2 million acre-feet per year by 2060 is plausible. Moreover, the greatest increases in demand are projected to occur in the Lower Basin. The Basin Study also illustrates that because of the magnitude and distribution of the imbalances, no single solution will be adequate to meet all future water demand and supply imbalances.

The Study confirms that without future actions, the Basin faces a range of potential future imbalances between supply and demand. A wide range of future imbalances is plausible and each of those imbalances results in the decline in the performance of Basin resources including water deliveries, hydropower, water quality, ecological, and recreational resources.

The Study also demonstrates the implementation of a broad range of options that can reduce Basin resource vulnerability and improve the Colorado River system’s resiliency to low and variable hydrologic conditions. The Study identifies a series of next steps that should be taken to begin to discuss what actions should be pursued to ensure the sustainability of the system. One of the options that the Bureau of Reclamation and the Basin States explored within the Study was pursuing additional agricultural conservation and water transfers. This is not surprising or a new concept in the western United States. Many thousands of acres of agricultural lands have already been dried up within Colorado and throughout the West to meet growing municipal and industrial demands. This trend of transferring agricultural consumptive uses to growing municipal and industrial uses has real and far-reaching implications and effects. In Colorado alone, the trend has prompted policy makers to fund studies that explore and potentially provide alternatives to agricultural transfers. Tools like interruptible supply agreements, temporary fallowing arrangements, deficit irrigation techniques, water banks, improved infrastructure, and other tools are being developed and used throughout Colorado and the other western states.

#### NEXT STEPS

While the Colorado River Basin Study provides new tools and answers a number of critical questions about the future of the Colorado River, it has raised new and different questions. The Bureau of Reclamation and the Basin States recognized that with the completion of the Colorado River Basin Study, their work was not done, but rather it was just beginning.

The Bureau of Reclamation and the Basin States agree that there are three key areas where additional work is immediately necessary: 1) municipal conservation; 2) agricultural conservation and transfers; and, 3) recreational and environmental flows. Thus, the Bureau of Reclamation and the Basin States formed three workgroups to tackle specific scopes of work associated with each of these subject matters.

The Basin Study estimated that one million acre-feet of water can be conserved from agriculture by the year 2060 to fill the estimated gap that will exist between water supply and demand. Agricultural water conservation has been proposed to reduce the overall water demand in areas currently relying upon water supply from the Colorado River system. The concepts received were first organized into six agricultural water conservation measures reflecting different types of activities that

could generate water savings in the agricultural sector. The six agricultural water conservation measures consist of:

- Advanced irrigation scheduling
- Deficit irrigation
- On-farm irrigation system improvements
- Controlled environment agriculture
- Conveyance system efficiency improvements
- Fallowing of irrigated lands

In order to encourage adoption of the targeted water conservation measures, two possible implementation approaches were considered: (1) Basin-wide agricultural water conservation through a federal or state incentive-based program to encourage agricultural water use efficiency without specific legal transfer of water or water rights, and (2) Basin-wide agricultural water conservation with water transfers between a willing transferor and willing transferee that promotes water conservation and/or short-term or permanent fallowing of irrigated lands to transfer conserved water to the transferee for a similar or different use.

The six agricultural water conservation measures have been conceptualized into two implementation approaches: 1) incentive-based programs to reduce agricultural demands and 2) water transfers to augment supplies. Because the conservation measures could produce different amounts of savings depending on the location in the Basin, implementation approach, and combination of conservation measures, the total quantities were estimated as an aggregate for each implementation approach rather than a summation of individual conservation measures. Up to 1 million acre feet of potential savings by 2060 was considered for both approaches combined with potential of roughly 500,000 acre feet under each approach category. By comparison, the summation of potential water savings for each conservation measure totals 2.44 million acre feet per year when accounting for non-consumptive use savings outside the Basin and ignoring return flow impacts, and is reduced to 833,000 acre feet per year when only consumptive use savings are considered under each approach category.

#### AGRICULTURE CONSERVATION AND TRANSFERS WORKGROUP

The “post-Basin Study” workgroups are being set up to dig deeper into the details. A “coordinating committee” will oversee and coordinate the activities of these three work groups. The result will be a draft report that is scheduled to be released later this year.

I will be co-chairing the Agriculture Conservation and Transfers Workgroup, along with the Bureau of Reclamation’s Ken Nowak and Tina Shields, of the Imperial Irrigation District.

The Agricultural Conservation and Water Transfers Workgroup is intending to collect information and prepare a report that: quantifies agricultural conservation and transfers of Colorado River water (both in and outside of the Basin) that have occurred to date, documents programs that have been successful to date, documents impacts and tradeoffs, lists any existing future plans for these types of activities, and estimates what potential savings could come from these existing plans. From this baseline information, this workgroup will also propose Phase 2 activities to be conducted in 2014 to the Coordination Team.

Members of the Workgroup include:

##### Co-Chairs

Ken Nowak, Reclamation  
Tina Shields, Imperial Irrigation District  
Reagan Waskom, Colorado State University

##### Members

Doug Bonamici, Colorado River Indian Tribes  
Astor Boozer, Natural Resources Conservation Service  
Grant Buma, Colorado River Indian Tribes  
Aaron Citron, Environmental Defense Fund  
Chuck Cullom, Central Arizona Project  
Aaron Derwingson, The Nature Conservancy  
Anisa Divine, Imperial Irrigation District  
Eslton Grubaugh, Welton-Mohawk Irrigation District  
Jeff Johnson, Southern Nevada Water Authority  
Mark Johnson, Coachella Valley Water District  
Janine Jones, California Department of Water Resources  
Dave Kanzer, Colorado River District  
Dan Keppen, Family Farm Alliance

Randy Kirkpatrick, San Juan Water Commission  
 Eric Klotz, Utah Division of Water Resources  
 John Longworth, New Mexico Office of the State Engineer  
 Jan Matusak, Metropolitan Water District of Southern California  
 Lee Miller, Southeastern Colorado Water Conservancy District  
 Don Ostler, Upper Colorado River Commission  
 Pat O'Toole, Family Farm Alliance  
 Halla Razak, San Diego County Water Authority  
 Russ Schnitzer, Trout Unlimited  
 John Shields, Wyoming State Engineer's Office  
 Ed Smith, Palo Verde Irrigation District  
 TBD, Western Governors' Association/Western States Water Council  
 Tanya Trujillo, Colorado River Board of California  
 Warren Turkett, Colorado River Commission of Nevada  
 Grant Ward, Maricopa-Stanfield Irrigation and Drainage District  
 Erin Wilson, Colorado Water Users  
 Brad Wind, Northern Colorado Water Conservancy District  
 Ed Yava, Colorado River Indian Tribes

#### CONCERNS OF BASIN AGRICULTURAL INTERESTS

Agricultural interests throughout the Basin, from headwater areas in my state to the fruit and vegetable producers in the Imperial Valley and Yuma, are concerned with the future scenarios identified in the Basin Supply. I believe that Basin irrigation districts appreciate Reclamation and the Basin states for their collaborative effort that led to the completion of this important study. A key overall benefit of this study is that, from now on, all Colorado Basin parties can work from the same technical foundation. However, I also know that many agricultural interests are concerned that virtually every scenario assessed by the Basin Study shows a loss of Colorado River Basin irrigated acreage by the year 2060.

The Basin Study assumes that irrigated acreage in the Colorado River Basin will decrease by 300,000 to 900,000 acres during the time period 2015 to 2060. Policy makers and Colorado River stakeholders must understand the critical implications of taking existing irrigated agriculture out of production. We are already behind the curve when it comes to meeting the future food needs of the world. Every single acre of land that is taken out of production reduces our capacity to meet that demand.

Irrigated agriculture is one of the largest economic engines in the Western U.S., according to the 2012 Family Farm Alliance report, "The Economic Importance of Western Irrigated Agriculture". For a region that spans the 17 Western states, the total household income impacts derived from the "Irrigated Agriculture Industry", made up of direct irrigated crop production, agricultural services, and the food processing and packaging sectors, is estimated to be about \$128 billion annually.

There are concerns about how the quantity of agricultural water that can be conserved was developed in the Basin Study. Once we have a firmer hold on that number, I'm hoping we can spend our time focusing on incentives and solutions to actually fill the gap. Some of that will certainly come from improvements and expansions in infrastructure and some will come from temporary, voluntary transfer methods like the water bank concept included in the Study.

We need to ensure that in-basin agriculture has the tools to remain resilient and profitable in the face of reduced supplies and increased pressure from cities to buy up agricultural land and water. Those tools can be directed to provide healthy flows benefits without permanently taking land out of production. Diversion and infrastructure improvements that can improve flows without drying up land are a good example. Healthy irrigated agriculture in the Basin provides value for water in place and gives environmental interests a partner to work with on conservation projects.

#### PAST HISTORY CAN PREDICT FUTURE ACTIONS

Several of the entities who are represented on the Ag Workgroup participated in the Colorado River Ag/Urban/Enviro Water Sharing forum a few years ago. Water used for agriculture in the Colorado River Basin and the western United States is increasingly seen as a potential supply for growing urban and environmental needs. In 2008, the Western Governors' Association, working through their water arm, the Western States Water Council (WSWC), issued Water Needs and Strategies for a Sustainable Future: Next Steps. One of the next steps identified in the report was that "...states, working with interested stakeholders, should identify innovative ways to allow water transfers from agriculture to urban use while avoiding or mitigating damages to agricultural economies and environmental values." In direct and inde-

pendent response to the WGA's call to action, a diverse Water Sharing Work Group of highly knowledgeable and influential water leaders representing the sectors of agriculture, urban interests, and the environment, set aside parochial positions to collaboratively take on the governors' challenge.

One of the first issues the group resolved focused on the very nature of water transfers. Some in the group did not want to participate in any process that would somehow encourage additional water to be transferred out of agriculture. An essential first step in building the collaborative process was to come to the decision that the group would focus on ways to improve sharing of water between multiple sectors, and would not seek to find more ways to unilaterally transfer water out of agriculture.

This group also recognized that there was a need for additional dialogue on the role of storage. Faced with mounting demands to provide water for urban growth and other beneficial uses, including agriculture, some members of the group identify themselves as pro-storage. Others remain leery of the potential adverse impacts and costs associated with some storage projects. However, the group generally accepted the concept that there may be benefits to properly sized and located storage in certain circumstances, especially when such projects are part of a larger, multiple-benefit strategy. The group also generally agreed that when projects have the support of multiple entities, including agriculture, environmental, and urban players, the regulatory process for approval of such projects should be better integrated, more conducive to moving forward, and less embroiled in redundant action by multiple agencies.

I helped facilitate the Ag/Urban/Enviro effort, and based on that experience, I think I have a good sense of the issues that we will tackle in the Workgroup I will be co-chairing. Colorado Basin agricultural interest will advocate that States and local governments consider the impacts of continued growth that relies on water transfers from agriculture and rural areas and to identify feasible alternatives to those transfers. Also, I'm certain the topic of aging infrastructure will come up. Aging Federal water infrastructure in the West must be addressed, as failure to reinvest in critical facilities will negate economic gains of past generations and create a failed legacy for future generations. It is imperative that we find creative ways to provide for the operation, maintenance, and modernization of existing water supply infrastructure. And, Colorado River Basin farmers and ranchers have long advocated for new water and power supplies, which they see as necessary to satisfy recreational and environmental needs, allow for population growth, and protect the economic vitality of the West. They would like the federal government to adopt a policy of supporting new efforts to enhance water supplies and management flexibility, while encouraging state and local interests to take the lead in the formulation of those efforts.

Irrigated crop production has a long history of innovation and adapting to changing conditions. New technologies and more efficient use of water are constantly being developed and voluntarily implemented throughout the irrigation belt of the West. The recent drought has certainly accelerated new technology and these advances in irrigated agriculture are most often first introduced to producers through the USDA Farm Bill programs. EQIP and the other programs target proven conservation practices and provide technical and financial assistance to farmers and ranchers as they continue to voluntarily reduce water use and improve irrigation efficiencies. Farmers need conservation programs such as EQIP and the CREP to assist, not subsidize, them as they face extremely difficult water conservation challenges caused by both drought and growth.

#### CONCLUSION

I am pleased that Reclamation and the Basin States are committed to the continued refinement of scenario planning as part of a robust long-term planning framework for the Basin. Policy makers and elected officials must clearly understand the importance of Western irrigated agriculture and the implications associated with transferring the water currently producing food in the Colorado River Basin and elsewhere.

At the appropriate time, federal authorizations or appropriations may be recommended or suggested as a result of the deliberations by the Workgroups and the States. We look forward to working with the Congress as we address these future challenges.

Thank you for this opportunity to present testimony to you.

Senator UDALL. Dr. Waskom, thank you.

Let me recognize myself for 5 minutes to direct some questions to the panel. We've been joined by my colleague and friend, Senator Flake from Arizona. When I've completed my 5 minutes, I'll recognize him for questions he may have.

Dr. Waskom, in your testimony you suggested it may be possible and encourage more conservation on Ag lands. Can you give us some examples of how the industry can work with less water, but still maintain the productivity required to feed our country? Can you explain in a second section how the Farm Bill programs like EQIP and CSP are helping conservation efforts in Ag?

Mr. WASKOM. Thank you, Mr. Chairman.

That's a very important question. So we know that we can conserve water in agriculture. You state that well. The question is can we do that and still maintain productivity, right? That is the difficult question as well as can we do that, maintain productivity and transfer water to other uses. That's where the complexity and the tradeoffs really fall in.

So yes, there's mechanisms. We can do that by fallowing marginal lands, by upgrading our infrastructure, by improving diversions, canal structures on farm irrigation. There's a number of tools in the bag of tricks.

But what we have to keep in mind is that irrigation is a risk minimization strategy, right? We use that water to produce food with. When we get tighter and tighter on the amount of water that we have to use, the greater the risk that producers face.

Relative to farm programs I think EQIP, the Ag Water Enhancement Program, the Conservation Stewardship Program. All of those have been very important in incentivizing producers, helping them with assistance to get some of these practices on the ground, so through both technical assistance as well as financial assistance.

Senator UDALL. Let me turn to Ms. Hawes.

You highlighted the Basin's, I think \$26 billion is the number you used, recreational economy. That's generated by 5 million adult visitors, 2,034 thousand jobs are supported.

Can you provide some insight on the ecological and recreational areas that are most at risk in the River Basin? I'm sure you have some sense of what the potential economic impacts might be given various thresholds of effects.

Ms. HAWES. Certainly.

A lot of the impacts are very local in nature. So there are endangered species, threatened species throughout the Basin on smaller tributaries like the Delores, the San Pedro. They're certainly impacts all throughout.

There's booming recreational economies throughout the Basin. In your home State lots of places like Aspen, Vail that depend on a healthy river system for their economy and for their tourism.

So there are some places in the Basin that we want to focus on first, what we consider Integrator Rivers. If you can protect those rivers they have a bigger bang for their buck, so to speak. Some of those might be places like up the Green River, the San Juan River, the Upper Colorado, the Yampa.

Some of those Upper Basin tributaries really impact the whole system and provide recreational opportunities all the way down. We owe that water down to Lake Powell anyway. So we're just try-



ing to figure out ways to see how we might enhance those resources as they go down to Lake Powell.

In terms of some of the impacts I think there's quite a few.

First there's the impact to businesses that rely on the river whether that's rafting companies, angling, you know, fishing guides, wineries. In Grand Junction there's lots of different businesses that rely on the river. There's also communities along the river that rely on helping a healthy river for their tourism, as I mentioned.

There's also a recent study out. That just came out yesterday about real estate values and how they're linked to having a healthy river. So I think we'll see things like as rivers, I think the study said and I have not had a chance to look at it yet, that the headline was, "As Flows Drop How Does That Affect our Real Estate Values?" The idea is that it's a negative one. People like to live along a healthy river.

Also there's an avoidance cost I think when it comes to endangered and threatened species. It costs a lot of money to recover a species. It's much easier to find proactive ways to protect a species before they're threatened.

So there are some species that are on the edge. Our goal would be to make sure that those species don't fall off the edge. That has benefits for all of us because if you have an Endangered Species Act compliance program that reduces the flexibility of water users.

So we want to make sure we're not creating that situation. But that means having a healthy river system.

Then last I would mention hydropower. That's a flow benefit in many parts of the Basin. That's a big driver. In fact I met the head of the Regional WAPA, Western Area Power, person on the plane yesterday who was coming out here to talk to folks about flows and how they're concerned about Lake Powell and Lake Mead.

So I think there's a lot of different things that we don't necessarily think about when we think about healthy flows. But they're all connected in having a healthy river system.

Senator UDALL. Let me recognize Senator Flake. I know he has a fellow Arizonan here. Ms. Ferris I also think my family had some involvement in the good work you all have done in Arizona.

Ms. FERRIS. Yes, indeed, Senator Udall. I was thinking about my last visit here was 30 years ago when I was coming here to save the CAP by passing a ground water code. I had the great privilege of meeting your Dad at that time. It was terrific.

Senator UDALL. He had a long history with the CAP. I know Senator Flake's family does as well.

Ms. FERRIS. Yes.

Senator UDALL. I think I said earlier, Senator Flake, that it was said in the West that the Lees and Udalls are everywhere and we're related. But the Flakes are everywhere as well.

[Laughter.]

Senator UDALL. It's great to have—

Senator FLAKE. I was watching in my office and I was quite offended I was left out there.

[Laughter.]

Senator UDALL. Senator Flake.

Senator FLAKE. I appreciate that.

Senator UDALL. What was yours?

Senator FLAKE. Thank you.

Ms. Ferris, you have obviously a long history and have done so much good work in the State Ground Water Act. What? Thirty-three years ago now?

Ms. FERRIS. Yes.

Senator FLAKE. It has stood the test of time and then some. I can tell you people who fly into Sky Harbor and look around and see the amount of development that has happened. They all ask the same thing. How are you able to do it in a desert like this?

It was because of a lot of foresight and a lot of actions taken early on and sticking to the plan. I commend you for the good work early on and for all the good work since.

Ms. FERRIS. Thank you.

Senator FLAKE. You mentioned in your testimony and I'm sorry, I listened to part of it and had to run over here. That you don't believe that conservation will be able to make up for the deficiencies in the future. It's going to take augmentation. Do you want to elaborate on that and in what way, what kind of augmentation are you talking about?

Ms. FERRIS. Mr. Chairman, Senator Flake, yes, I do believe that we need a comprehensive approach. As I said in my testimony conservation and reuse are essential. But we have to expand our thinking and look at what other possibilities are out there.

I know that in Arizona we look locally first and then we try to look regionally at what we can accomplish regionally. I think that's what we're going to have to do in this situation as well. I'm not sure we can find a silver bullet to the whole problem. We're going to find regional and local approaches.

But one of the things that's been discussed is desalinization. There is an option to look at desalinization along Southern California and in the Gulf of Mexico and use that water to meet Southern California's demands in a trade for using some other Colorado River elsewhere.

So and that got pretty high remarks, I think, in the study in terms of economic viability. There's a lot of permitting required. I know that.

But we also have the Yuma desalter in Yuma that has been mothballed for a long time. We know there was a trial program. We've got to explore them. We've got to explore all of them.

Senator FLAKE. With regard to where direction ought to come from, like I said, I think all of us praise what has been in Arizona. A lot of forethought went into it.

What role do you see for Congress to take place? It looks as if local expertise is where it's at here. But what to you see as a role for Congress moving ahead?

Ms. FERRIS. Mr. Chairman, Senator Flake, I think that we need to complete the next steps of this study and try to sort out if there is a role to be played at the Federal level. I think first though it's really up to the States working with Reclamation to try to develop solutions that everyone can agree upon and that we can then, if we need Federal or congressional help then we come forward with the ask.

But I'm not sure we're there yet. I know that it's going to take a lot of work at the Basin level, with the States, working together with Reclamation to really figure out those solutions.

Senator FLAKE. Thank you. That's certainly what I prefer because I've seen the good work locally. If we're a last resort and obviously there are functions that Congress needs to perform here.

But to the extent that can be done locally that's certainly the preference.

Mr. Waskom, Ms. Hawes, do you want to talk about how these proposed solutions being talked about will be crafted in a way to protect some traditional agriculture. I know there's always concern in some of the agricultural communities that plans and moving ahead, in terms of water resources, will somehow leave them out.

What can we do to make sure that doesn't happen?

Ms. HAWES. You go first.

Mr. WASKOM. Thank you, Senator.

My response to that would be part of what we're doing with the workgroups is really engaging a broad base of stakeholders from the top to the bottom of the Basin, agricultural stakeholders, folks that manage water on a day to day basis.

I think really to answer your question we need to work closely with the irrigation districts in the Basin. They manage the water. They will know what the degrees of freedom are to move water around and where we can conserve and perhaps where we can augment it for the sake of agriculture as well.

So that would be my response.

Senator FLAKE. OK.

Ms. Hawes.

Ms. HAWES. Yes, thank you, Senator.

In the State of Colorado we're looking at water banking in the State of Colorado as a mechanism to deal with compact compliance. But I think it has broader ramifications and the way that we're working with irrigators and cities and Reclamation and the tribes. We've hired an Agricultural Outreach Coordinator just to be talking to agriculture because without agriculture there is no solution.

Senator FLAKE. Right.

Ms. HAWES. It has to be voluntary. It has to be something that works for them. When we talk about the water bank in Colorado our first line is if you're not on board this can't go forward.

So we're really spending a lot of time exploring what their local concerns are. What, you know, there's economic issues. There are environmental issues within their own property sometimes.

It has to work for them economically. I think we're spending some time trying to understand the technical issues that they are facing through fallowing and deficit irrigation and crop rotation. All those things have to be explored and we have to make sure their concerns are addressed.

Senator FLAKE. Thank you.

Ms. Ferris, do you have anything to add to that or I know you're limited in time for your opening statement. Is there anything else that you'd like to cover?

Ms. FERRIS. Mr. Chairman, Senator Flake, you know it's always a balance. That's how it feels to me. After all these years I've spent

on this issue you really have to have collaboration among all the affected parties or nothing works.

Senator FLAKE. Right.

Ms. FERRIS. So I'm a really big believer in that. I'm a really big believer in bringing everybody to the table and trying to forge the necessary solutions.

Senator FLAKE. It is a tough balance. Property use and protecting property owners and conservation and supply, everything, it's a tough balancing act and manage to do it pretty well in Arizona. Thanks for all of your hard work here.

So, thank you.

Ms. FERRIS. Welcome.

Senator UDALL. Thank you, Senator Flake.

I, too, want to acknowledge the visionary work you've done in Arizona. I think many other States have taken a look at what you've accomplished and said, "what can we apply in our State?"

I know you work closely with most of the time, Ms. Mulroy, up in Las Vegas.

Ms. FERRIS. Yes.

Senator UDALL. Senator Flake, I'm inclined to think if we turn Ms. Ferris and Ms. Mulroy loose they might figure this all out for all of us.

[Laughter.]

Ms. FERRIS. Just put us in a room together we'll do fine.

Senator UDALL. But anyway, I wanted to follow up a little bit on what Senator Flake was discussing with you about some of the successes you've had.

Your working group, I think, is examining reuse as one of the future supply options. How do you take that into account as you examine the impact of enhanced reuse on downstream water users, most notably agriculture?

Ms. FERRIS. Senator Udall, really good question. It's really why we have these workgroups, I think, because if you read the study, especially on the reuse part it's pretty thin. There are some assumptions made that we can achieve 930 thousand acre feet of savings through reuse, but it's very global. It acknowledges that we have to dig deeper.

So that's really what the workgroup will do.

I think again, we have to look regionally and locally because laws vary, as you know, from State to State. So in Arizona, for example, cities that treat waste water, that waste water becomes theirs. They can contract for it.

That's part of the reason we've been so successful in reusing waste water in Arizona. Because we've been able to sign contracts with power plants and use the water for riparian areas and use it for industrial purposes.

The laws in other States are very different. So obviously you've got to protect property rights as we go along. So we're just going to have to dig deeper into what is the existing law and the existing structures in different areas and really determine what we can really get from reuse and how we can do it in a way that doesn't impact vested water rights.

Senator UDALL. I look forward to hearing more about that.

We're beginning to do more of this in Colorado. You're probably familiar with the city of Aurora, the second largest city. They've just opened a significantly sized reuse plant. Prairie Waters, I believe, is the name of the plant. It's raised some of those legal questions you just surfaced as well.

But it's where we have to go as one of the solutions.

In the end, though, augmentation is going to be important as how you augment and the effects that Ms. Hawes touched on.

I want to turn to you, Ms. Hawes, for the last question before we conclude the hearing.

Can you share some examples of a situation where multiple needs have been balanced between municipal, power, recreational, environmental and Ag users? If you could, include any of the key factors that resulted in those successes?

I'm assuming you have a few or I wouldn't ask that question.

Ms. HAWES. Thank you, chairman.

As I described in my testimony we have some great examples. I think that's what gives me such hope. I'm definitely an optimist, as well, but if we didn't have so many great examples I think it would be harder to make the case.

There's an example in Northwest Colorado where through the Upper Basin Recovery program which as we heard earlier is such a model for success.

We enlarged a small reservoir so it was an existing reservoir. It didn't have to go through huge permitting hoops. But they raised the level of the reservoir to get another, to achieve an increased yield of about 15,000 acre feet of water.

They then divided that in thirds.

One third for the fish, for the endangered fish.

One third for a local power plant.

One third for local communities and agricultural interests available by contract.

So I think that's one example, kind of a local one, but where again the key factor was political will. Everybody recognized that it was necessary. We needed better base flows in the region. All the parties came together. They did the financing was easy and the permitting was a breeze by today's standards.

So once you have all those parties in agreement it makes it a lot easier to, kind of, push the project forward and meet all those multiple purposes.

Another recent example is the bi-national agreement, Minute 319. My point I'd like to make is if we can do that with Mexico, we can do that with recreational interests and environmental interest around the Basin. So in that example there was multiple benefits being met.

It was tourism in Mexico. It was environmental flows and restoration for migratory bird habitat in Mexico. There was shortage sharing between the two countries as well as surplus sharing if we're ever so lucky to have that day again.

There was also investment from the cities in the U.S., in Mexico's infrastructure and then they got real water in exchange in Lower Basin cities. So I think that's another great example.

In my testimony I also describe an example in the San Pedro River in Arizona where ground water levels were dropping. It was

affecting the river, but it was also affecting the community. So through good science and a lot of time spinning out, figuring out exactly what was the problem.

They were able to identify key recharge locations that could be used. It can use effluence and storm water to recharge in these key locations, recharge the ground water which not only benefits the communities, but it also benefits the river. We've been able to track that progress along the way.

So I think there are great examples out there. I could go on, but I think that we can see all around the Basin that there are good examples of us finding ways to meet all these multiple purposes. The key factor, in my opinion, is political will.

Senator UDALL. Political will.

That's very helpful. You all have provided some fascinating, crucial testimony. It may not be as fascinating to people who live east of the 100th meridian, but it's very fascinating to us who live beyond the 100th meridian, which, of course, was the title of a well-known book that talked about the original belief on the part of the settlers. The Native people were a little wiser than the settlers were. But the rain follows the plow.

We're now looking for a new construct in the 21st century that combines your optimism with the realism that this study lays in front of us. I'm confident we can, through technology and ultimately through political will, get to where we need to be. The very way of life we all love in the Southwest depends on it.

So thank you again for your important testimony. We will keep the record open for two more weeks to receive any additional comments. Some of the committee members may want to submit additional questions in writing, and I know you all will be happy to submit answers for the record.

I also want to thank the first panel which was an important part of this hearing as well.

With that, the subcommittee is adjourned.

[Whereupon, at 4:15 p.m., the hearing was adjourned.]

## APPENDIXES

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### APPENDIX I

#### Responses to Additional Questions

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##### RESPONSES OF MIKE CONNOR TO QUESTIONS FROM SENATOR UDALL

*Question 1.* As climate change could have a major impact on the amount of water available in the Colorado River Basin, how can states, tribes, and local entities prepare for and adapt to such conditions?

Answer. While climate models do not definitively agree upon the net impact climate change may have on Colorado River flow, annual (natural) historical data of the past 20 years averages nine percent below the long-term mean (1906-2013). Further, considering the past 14 years, annual average flow has decreased by twice that amount (down to 82 percent of long-term mean). Recent measured flow reductions, coupled with a considerable number of climate models projecting further reductions in flow, suggest that it is prudent and essential to plan for future decreases in water supply.

As we continue to encounter significant drought conditions, the communities that rely on the river to sustain them are being forced to make tough choices. It is likely that climate change and its emerging challenges will have major consequences on the Colorado River system. There is no silver bullet to solve these challenges. Fortunately, the level of cooperation among key stakeholders has never been higher and as a result, there is reason for optimism, even in the midst of the daunting challenges that exist in this Basin. The Department will continue to be a partner in assisting the Colorado River Basin to prepare for, and successfully address, the significant issues identified in the Bureau of Reclamation's Colorado River Basin Supply and Demand Study (Study). The Study, along with the wide array of adaptation and mitigation strategies proposed by stakeholders and the public, is an important step towards facilitating much needed collaboration amongst States, tribes, local entities and stakeholders in order to identify and move forward with practical solutions.

*Question 2.* Can you describe the role of the National Park Service with respect to the Basin Study? What, if any, will their role be in quantifying recreational and environmental flows in National Parks?

Answer. The National Park Service (NPS) played a role in the Study through its involvement in the collaborative development of the Study's system reliability metrics for ecological and recreational resources. These metrics were the measure of how well the Colorado River system may perform in the future under different water supply and demand scenarios, with and without the implementation of options to help resolve future imbalances.

The NPS will continue to be a key partner in the Study's next steps process. This continuing effort will require innovative thinking, integration of many viewpoints and a commitment to work in a positive and collaborative spirit.

The first part of this process builds on critical investigations identified in the Study as next steps and consists of the formation of a Coordination Team and three multi-stakeholder workgroups representing Federal, State, Tribal, agricultural, municipal, hydropower, environmental, and recreational interests. These workgroups will investigate: 1) Municipal and Industrial Conservation and Water Reuse, 2) Agricultural Conservation and Water Transfers, and 3) Environmental and Recreational Flows.

NPS representatives are members of the Coordination Team as well as the Environmental and Recreational Flows workgroup. The Environmental and Recreational Flows Workgroup has recently begun the process of preparing its work plan outlining near-term activities. The NPS Natural Resource Stewardship and Science Di-

rectorate includes technical experts in water resource management and climate change who will continue to support efforts to examine water supply, utilization, and ecological needs within the basin.

*Question 3.* As you examined the Basin Study's findings and the Bureau's storage infrastructure, how can existing infrastructure be better utilized? Please quantify the cost of these improvements, as well as the potential effect on regional supply or demand in the Basin.

Answer. Several ideas were received from the public related to the modification of current reservoir operations and construction of new storage. These options were not addressed quantitatively in the Study due to their complex legal and technical nature and their respective costs.

Reclamation recognizes that modified reservoir operations and infrastructure have been and will continue to be important tools used to adapt to and mitigate the impacts of future imbalances. These tools have been used in the past, which continue to provide benefits through the 2007 Interim Guidelines for Shortage, Surplus, and Coordinated Operations of Lake Powell and Lake Mead. Brock Reservoir, completed in 2010, was collaboratively constructed by Reclamation and stakeholders in the Lower Basin States to respond more effectively to changing weather and river conditions, and conserve water.

*Question 4.* Are there ways the Bureau can help promote more effective and cost-efficient water use in coordination with its project beneficiaries?

Answer. Reclamation has made substantial progress in addressing Colorado River water management over the past several years, including the 2007 Interim Guidelines for Shortage, Surplus, and Coordinated Operations of Lake Mead and Lake Powell, the 2010 signing of Minute 318 and the 2012 signing of Minute 319 to the 1944 treaty with Mexico, the High Flow Experimental Protocol and Non-Native Fish Control programs adopted in 2010 at Glen Canyon Dam, and the WaterSMART (Sustain and Manage America's Resources for Tomorrow) initiative focused on prudent water management and new technologies to address upcoming gaps in supply and demand.

Through WaterSMART, Interior agencies work with state and local water managers to plan for climate change, drought and other threats to water supplies and consider their potentially interrelated effects, taking action to secure water resources for communities, economies, and the ecosystems they support. In July 2013, Reclamation announced \$8.2 million in WaterSMART funding for projects to assist the Colorado River Basin by augmenting water supplies, conserving and reusing existing water supplies and planning for the future of the Basin. Interior awarded \$2.8 million in Water and Energy Efficiency Grants for seven projects, \$1.8 million for one Basin Study and one plan of study and \$3.6 million for water reclamation and reuse projects in Albuquerque, NM and Long Beach, CA.

*Question 5.* Do you anticipate that further studies will show that the location of water demands will not always correlate well with the location of potential supplies, resulting in a need for additional transport infrastructure?

Answer. The system reliability analysis conducted as part of the Study indicates that Basin resources (water deliveries, hydropower production, and ecological and recreational resources) in locations throughout the Basin are vulnerable on some level to future supply and demand imbalances. However, the nature, timing, and magnitude of the future vulnerability are complex and dependent on a number of factors including the resource need and its location.

Although the Colorado River system is one of the most complex networks of water conveyance in the world, many other situations exist where the location of supply does not correlate with the location of demand. In some cases, existing stream and river channels or infrastructure can be used to achieve the necessary conveyance of water. Many of the augmentation-type options to resolve future supply/demand imbalances considered in the Study require additional transport infrastructure. The Study's portfolio analysis demonstrated that many resource vulnerabilities can be decreased considerably with a wide-range of solutions in place. The Study does not result in a decision as to how future imbalances should or will be addressed, and Reclamation has not taken a position on the merits of any of these actions or whether it may ultimately support pursuing any individual actions.

*Question 6.* The Basin Study identified a greater-than-zero chance of a Colorado River Compact "call." Would Reclamation be prepared to participate in such an administrative effort within the confines of the Colorado River Compact? How would you see Reclamation's role in such an event? Does Reclamation believe the Basin States are appropriately prepared?

Answer. The Colorado River Compact is the foundation of the Law of the Colorado River as well as a key element of applicable federal law that establishes the framework for Reclamation's Colorado River operations. The Compact establishes rights



and obligations between the States of the Upper Division and the States of the Lower Division. It has long been recognized that in certain circumstances a “Compact call” could be invoked by one or more of the affected states. Working closely with the Department of the Interior, the seven Colorado River Basin States—as a group—have been aggressively engaged and successful in dealing with emerging challenges on the Colorado River in a cooperative and consensus-based fashion, particularly over the past 15 years. This effort has resulted in adoption of numerous proactive measures designed to reduce the likelihood of disruptive events, including circumstances such as a Compact call. Reclamation will continue to work to ensure that accurate and objective information is available for decision makers and stakeholders, and Reclamation will continue to work to facilitate cooperative solutions that can meet the challenges ahead, including those identified by the Study.

#### RESPONSES OF MIKE CONNOR TO QUESTIONS FROM SENATOR LEE

*Question 1.* The study (page ES-20) noted that not all stakeholders were in agreement with the results. Please elaborate on this statement. What results were stakeholders not in agreement with? Which recommendations were the most controversial among stakeholders?

Answer. As noted on page ES-20, not all stakeholders in the Study were in agreement with the option characterization results. The Study explored a broad range of options to help address future water supply and demand imbalances. Between November 2011 and February 2012, more than 150 ideas were received from stakeholders and interested parties to be included in the Study. A group of representative options, designed to represent the submitted ideas, were then “characterized” against a set of 17 criteria (e.g. cost, timing, technical feasibility, energy needs, etc.). These criteria were used to describe the options, provide a relative comparison of their attributes, and support the development of portfolios or groupings of options.

Although the characterization process strove for objectivity and consistency, there were limitations including geographic challenges due to the Basin’s large size and regional variety, the appraisal level of the analysis, potential subjectivity during the characterization process, and significant uncertainty due to limited data. It was recognized by all stakeholders that future efforts will result in a more in-depth assessment of the criteria, opportunities for additional research and development, and the improvement of available data.

*Question 2.* The Colorado River Supply and Demand Study indicated (page ES-21) that in early 2013 Reclamation would consult and work with tribes regarding tribal water rights issues reflected in the report. What consultation with tribes has occurred and what is planned for the next few years?

Answer. On May 28, 2013, in San Diego, Assistant Secretary for Water and Science Anne Castle and Commissioner Mike Connor joined dozens of stakeholders for a public event outlining a path of next steps for the Basin based on the findings of the Study. Darryl Vigil, Chairman of the Ten Tribes Partnership, provided an essential contribution to the event by presenting the tribal perspective on Basin needs. The next steps have included the formation of a Coordination Team and workgroups that will focus on the critical investigations identified in the Study. There are two Ten Tribes Partnership representatives on the Coordination Team as well as tribal representatives on the workgroups.

In addition, Reclamation is committed to its ongoing support of Tribal Nations. For example, jointly with the Ten Tribes Partnership, Reclamation will conduct a study related to tribal water use. Reclamation is currently discussing the objectives and scope of this study with the Partnership. Additionally, Reclamation is engaged in discussions with the Intertribal Council of Arizona to better understand their issues raised during the Study related to tribal water and is committed to continuing to seek resolution on these issues.

*Question 3.* What is Reclamation or Department of the Interior doing to bring in other federal agencies and programs during the identification of next steps for the Colorado River basin? Are U.S. Department of Agriculture programs (e.g., EQIP) that affect how water is used, drought resiliency, and agricultural water demands integrated into the next step efforts in the basin? Similarly, are U.S. EPA programs related to municipal water investments and water efficiency being evaluated for their potential contribution?

Answer. A process has begun which moves beyond the Study to address projected water supply and demand imbalances in the Basin. This continuing effort will require innovative thinking, integration of many viewpoints and a commitment to work in a positive and collaborative spirit.

The first part of this process builds on the critical next investigations identified in the Study and consists of the formation of three multi-stakeholder workgroups

representing Federal, State, Tribal, agricultural, municipal, hydropower, environmental, and recreational interests. These workgroups will investigate: 1) Municipal and Industrial Conservation and Water Reuse, 2) Agricultural Conservation and Water Transfers, and 3) Environmental and Recreational Flows.

Federal members on these teams represent a broad spectrum of federal agencies: Department of the Interior (Reclamation, National Park Service, U.S. Geological Survey, U.S. Fish and Wildlife Service), and Department of Agriculture (Natural Resources Conservation Service, U.S. Forest Service) agencies.

Near-term activities include documenting the success of municipal and agricultural conservation programs, estimating the amount of additional water saving each program may achieve by 2060, and compiling a listing of best practices. Savings occurring from USDA and/or EPA programs will be addressed through this task.

*Question 4.* No cross-cut budget for federal activities in the Colorado River basin affecting water demands and supply is publically available. Cross-cut budgets for a wide variety of federal agencies are regularly produced for the Florida Everglades restoration, California Bay Delta restoration, and the Great Lakes. Would there be value for producing a similar budget for the Colorado River water supply and demand in order to better understand the current federal role?

Answer. Reclamation already closely coordinates with a number of federal agencies on Colorado River operations, planning, and ecosystems. These include the National Weather Service, Natural Resources Conservation Service, U.S. Army Corps of Engineers, and several agencies within the Department of the Interior including U.S. Fish and Wildlife Service, U.S. Geological Survey, and the National Park Service.

*Question 5.* Among individual “representative” options included in each of the portfolios, how does current spending in the basin compare with the estimated range of costs for these actions in the recommended portfolios? (i.e., What would be the required increase in investment in individual areas?) For example, how much is currently spent per year on desalination compared to the recommended investment in portfolios A and B? How much is spent on weather modification, which is recommended in all portfolios?

Answer. The Study considered four portfolios, each different in options, potential yield and associated costs. For a given portfolio, the actual investment was variable, depending on the demand and supply scenarios. This variability, coupled with uncertainty regarding current spending on option-type programs makes determining the “suggested additional investment” challenging. Ultimately, Basin-wide investment “need” is likely to exceed current funding levels (both federal and non-federal) for most options considered in the Study. The exact amount will depend on a variety of factors, including but not limited to region, option type(s) and desired yield.

As part of the Study’s next steps, work groups are actively engaged in activities that examine existing agricultural and municipal conservation programs. Conservation was among the most frequently proposed options considered in the Study. Significant conservation efforts are already underway, but additional efforts could reduce supply-demand imbalances. Products from these workgroups will quantify previous efforts (in both water savings and dollars) and illuminate the additional effort, financial and otherwise, to achieve the additional levels quantified in the Study.

The other major category of options can be broadly described as augmentation: developing other water supplies to ease the burden placed on the Colorado River. Currently few projects exist that fall into this category. The Yuma Desalting Plant (Yuma, AZ) was completed in the early 1990s and has a capacity to conserve approximately 100,000 acre-feet/year. In Carlsbad, CA, a 56,000 acre-feet/year desalination facility is scheduled to be completed in 2016. For comparison, desalination options modeled in the Study offered a potential yield of about 1.5 million acre-feet/year by mid-century. Thus, in the case of desalination, the maximum rate of development would constitute an approximate 10-fold increase relative to the past 35 years. Given increasing costs per acre-foot associated with option implementation and the potential for imbalances to increase over time, it is prudent to assume that additional Basin-state investment beyond current levels will be required.

*Question 6.* How confident is Reclamation in its estimates of the potential costs for the portfolios? Please elaborate further on the basis for these estimates and the major assumptions used. The costs appear to range from \$4 billion to \$7 billion annually in 2060 (in 2012 dollars).

Answer. As part of the option characterization process, all submitted options were characterized using 17 evaluation criteria and the relative cost of an option was one of the characterization items. The cost criterion included capital and annual costs expressed in terms of unit costs in dollars per acre-foot. The option costs were estimated based on limited and high-level analyses. Therefore, knowledge of items such as costs, permit requirements, and long term feasibility are highly uncertain. For

example, cost estimates for infrastructure-type projects are based on similar past projects with adjustments for parameters such as scale and location. These adjustments are approximate, especially for projects where the scale of the project is larger than any previously completed similar project. Past studies by the Association for the Advancement of Cost Engineering show that concept-level estimates can typically have an expected error range of between 30 to 50 percent. Cost estimates for non-structural type projects are often even more uncertain because historical documentation of costs for similar past projects are often not fully applicable or fully documented, or such projects are based on changes in human behavior. Despite the uncertainties in estimating the magnitude of costs, a significant effort was made to provide cost estimates that are useful when considering relative costs.

*Question 7.* Of the specific options and strategies outlined within the portfolios, which options are the most and least viable? Was there any effort to quantify which options were the most and least cost effective, in terms of cost per acre-foot?

Answer. As part of the option characterization process, each option was characterized using a set of 17 criteria, including both quantitative criteria such as timing of implementation, annualized cost per acre-foot, yield, and energy use, and qualitative criteria such as technical feasibility and implementation risk. The cost criterion included capital and annual costs expressed in terms of unit costs in dollars per acre-foot, however the option costs were estimated based on limited and high-level analyses. Therefore, knowledge of items such as costs, permit requirements, and long term feasibility are highly uncertain.

The Study shows that no single option or project will be adequate to meet the varied needs of the Basin under the range of future scenarios considered. Indeed, the four portfolios (groups of options) evaluated in the Study indicate that a diverse combination of options has the potential to reduce resource vulnerability. Future planning will require careful consideration of the timing, location, and magnitude of anticipated future Basin resource needs. The purpose of exploring the options and portfolios is not to identify a “best” portfolio or strategy, but to acknowledge that there are various ways to address the water supply and demand imbalance and to recognize that each approach has implications to be considered in future planning processes and decisionmaking.

*Question 8.* What is the current status of federal salinity management issues in the basin, and how are salinity concerns being integrated into the decisions about next steps for water supply and demand?

Answer. Reclamation partners with the seven Colorado River Basin States (Basin States) and other federal agencies to meet the target objective of reducing the annual salinity load in the Colorado River by 1.8 million tons by the year 2030 under Title II of the Salinity Control Act (PL 93-320) (Act). Currently, federal agencies and their salinity control programs prevent about 1.3 million tons of salt from the Upper Colorado Basin from entering the Colorado River system each year. Reclamation’s salinity control programs control about 570,000 tons of that annual total.

The Act also authorized funds deposited into the Upper Colorado River Basin Fund and the Lower Colorado River Basin Development Fund (Basin Funds) from a surcharge on power produced at Reclamation facilities to be advanced to cost share 30 percent of the cost of the Title II salinity control programs authorized by the Act. In recent years Reclamation has received about \$8 million in appropriations for its Basinwide Salinity Control Program to fund with the cost share from the Basin Funds the installation of the salinity control measures with an average unit cost of about \$55/ton.

Under Title 1 of the Act, Reclamation constructed salinity control facilities to meet United States’ obligations under Minute 242 of the 1944 Treaty with Mexico. These facilities and programs currently enable Reclamation to maintain acceptable salinity levels in the water supplies delivered to Mexico, including the collection and analysis of data and reporting of salinity compliance. The Study’s next steps process do not address salinity concerns explicitly, however, the extent to which salinity concentrations are impacted by agricultural conservation and water transfers will be documented.

*Question 9.* How does Reclamation envision the future federal role in the Colorado River Basin? Is the federal role expected to change?

Answer. The Secretary of the Interior, through Reclamation, serves as the water master for the Colorado River in the Lower Basin and is the responsible federal official for the many water and power projects throughout the Basin, delivering water and power to the recreational, agricultural, environmental, and municipal communities that depend on the river. As such, Reclamation and Interior are well positioned to provide leadership to work towards the goal of sustainable water supplies in the Basin. The collaborative approach adopted by the Study was paramount to its success. As in the past, Reclamation and Interior can provide a leadership role

in furthering these partnerships so as to be well poised when new challenges and opportunities arise.

*Question 10.* In your opinion, what is the best model for basin-wide decision making and coordinated implementation of programs such as the “portfolio” options? Is there a comparable example of a decision making entity that takes into account all levels of interest and implements a coordinated strategy?

Answer. Reclamation does not believe there is a single “best” model for basin-wide decision making and coordinated implementation of programs, and recognizes the broad range of interests that would have to be considered in any such analysis. During preparation of the Study Reclamation received input comprising over 150 options from Study participants, interested stakeholders, and the general public. Some of the options focused on Basin governance and mechanisms to facilitate option implementation (Governance and Implementation). Reclamation noted that the governance/decision making concepts that related to water management and allocation (including Tribal water issues) have significant legal and policy considerations that will require future consideration and discussions and were beyond the scope of the Study.

#### RESPONSES OF MIKE CONNOR TO QUESTIONS FROM SENATOR BARRASSO

*Question 1.* Sections 201 and 202 of the Colorado River Basin Project Act direct the Secretary of the Interior to address the future water needs of the Western United States.

Section 202 declares that the—

“satisfaction of the requirements of the Mexican Water Treaty from the Colorado River constitutes a national obligation which shall be the first obligation of any water augmentation project planned pursuant to section 201 of this Act and authorized by the Congress.”

Does Section 202 of the 1968 Act have relevance or a bearing on what will be accomplished during the next phase of the Colorado River Water Supply and Demand Study?

Answer. The Colorado River Basin Project Act is an important element of applicable federal law and part of the overall Law of the River. Reclamation does not anticipate that Sec. 202 will directly affect or be determinative with respect to the multi-stakeholder fact-gathering efforts envisioned in the Study’s next steps process. Current effort builds on findings for critical next investigations described in the Study and consists of the formation of three multi-stakeholder workgroups to investigate and provide additional factual detail regarding: 1) Municipal and Industrial (M&I) Conservation and Water Reuse, 2) Agricultural Conservation and Water Transfers, and 3) Environmental and Recreational Flows. Additionally, in an effort parallel to these activities, Reclamation-led activities will include a joint investigation with the Ten Tribes Partnership, related to tribal water use in the Colorado River Basin.

*Question 2.* It seems highly unlikely that augmented water supplies in the Colorado River Basin will be dedicated to going to Mexico. How should we address Section 202 of the 1968 Act?

Answer. The question of how Congress should address Section 202 of the 1968 Act goes beyond the scope and analysis of the Study. During preparation of the Study, Reclamation received input comprising over 150 options from Study participants, interested stakeholders, and the general public, including options related to small and large scale augmentation concepts. A number of the options focused on Basin governance and mechanisms to facilitate option implementation (Governance and Implementation). Reclamation noted that a number of the governance/decision making concepts that related to water management and allocation (which would include issues involving augmentation under applicable law, including the 1968 Act) have significant legal and policy considerations that will require future consideration and discussions and were beyond the scope of the Study. In any future consideration of augmentation programs, the United States’ obligations to Mexico under the 1944 Treaty will have to be fully considered and integrated.

#### RESPONSE OF KATHLEEN FERRIS TO QUESTION FROM SENATOR UDALL

*Question 1.* In your testimony, you highlighted that the potential water saving figures included in the study do not capture the complexities of how municipalities manage their water, especially in regards to “out-of-Basin” cities like Denver and Los Angeles. Therefore, it becomes much more difficult to evaluate potential water quantity impacts on the Colorado River Basin as municipal water savings are likely

not directly proportionate to their different sources of water. What information would it be useful for municipalities to provide in order to have a greater understanding of the impact their water management decisions have on the Basin?

Answer. A municipal water provider considers many different factors if it has multiple sources of water to meet demands within its service area. Some of these factors include the volume of water in storage in surface water reservoirs, hydrologic forecasts of water supply availability, environmental issues that may impact the availability of supplies, water right restrictions and contractual requirements, cost of delivery of raw water to treatment facilities, cost of treatment to potable standards, quality of the raw and potable water, and cost to pump groundwater (if part of a supply portfolio). Consequently, there is variability in how providers choose to use their supplies from year to year.

Municipal providers should be able to provide historic data identifying how much Colorado River water they have used. In many cases municipal providers have forward looking water resources plans that can inform us as to how their future use of Colorado River water might shift over time.

The Municipal and Industrial Conservation and Reuse Workgroup will collect and analyze the necessary data, but it will take some time to accomplish this task.

#### RESPONSES OF KATHLEEN FERRIS TO QUESTIONS FROM SENATOR

*Question 1.* While Arizona's population increased from 5.1 million in 2000 to 6.3 million in 2010, water use remained relatively constant at 7.6 million acre-feet. Water use in 2010 was only 7% greater in 2010 than in 1957. What are the lessons from the Arizona experience for dealing with the demand-supply imbalance identified by the Colorado River Water Supply and Demand Study?

Answer. Arizona's experience demonstrates that a comprehensive water management program will yield the best results. All water sources—surface water, Colorado River water, groundwater and reclaimed water—must be addressed conjunctively. Arizona's approach employs regulatory and non-regulatory measures that often result in financial or other incentives for efficient use of water. This approach allows flexibility for water users to choose management options that work best for them, including balancing costs and rates.

Arizona's municipal conservation program, for example, has a regulatory requirement to reduce per capita consumption, but how reductions are achieved is left to each water provider. This has enabled each provider to create water savings programs that meet the unique circumstances of its service area and to allow its customers to choose from a menu of water conservation options rather than dictate specific measures. The resulting partnership between water providers and their customers that has been effective in reducing Arizona's water use over time.

An example of the value of more direct regulation is the Assured Water Supply program that requires new residential development to be served largely with renewable water supplies. Since the water resources and infrastructure to achieve compliance with this program are more expensive than using non-renewable supplies, such as groundwater, water providers are incentivized to use less water simply to control their costs. Arizona law also encourages the reuse of reclaimed water because the entity that treats the water is allowed to reuse that supply or contract with another for its reuse.

*Question 2.* Arizona's municipalities have combined strategies for providing water for decades through innovations in groundwater storage and water banking. What will the demand-supply imbalance in the Colorado River basin mean for the ability and cost of reliably delivering water to water users in Maricopa County? What actions and investments are your members undertaking or preparing for meeting future water needs? How are these investments being financed? What role can groundwater management play in improving water supply reliability?

Answer. The Central Arizona Project (CAP) shares the lowest priority for Colorado River water (along with Nevada) in times of shortages. If the projected shortages of Colorado River become a reality, Maricopa County water users, like many other water users in the Basin, will likely be required to curtail water use more often and will see increased costs.

Because we have always known that CAP water has a junior priority, Arizona and municipal water providers have invested in measures to prepare for shortages. The legislature established the Arizona Water Banking Authority in 1996 to store excess CAP water (water not used by other Colorado River entitlement holders) underground for use by municipal water providers in times of shortages of CAP water. To date, the Banking Authority has stored over 3 million acre-feet of excess CAP water underground.

AMWUA's members have undertaken and continue comprehensive efforts to enhance supplies and manage demand in order to meet future needs. These efforts have included:

- Ongoing long-range planning, including extensive research to understand future water demand trends, service area growth patterns, supply availability, impacts of drought and climate change, and potential regulatory impacts.
- Full reuse of reclaimed water for beneficial uses such as energy production, turf irrigation, agricultural irrigation, environmental restoration and enhancement, and recharge, offsetting potable supplies.
- Storing excess surface water supplies underground for use in times of shortages. To date, this storage amounts to over 1.6 million acre-feet.
- Protection of groundwater supplies to ensure availability in times of surface water shortage.
- Development of necessary infrastructure to store, recover, treat, and distribute supplies.
- Continued investment in programs to increase water use efficiency and conservation, including aggressive system leak detection and repair; increasingly sophisticated metering and tracking; customer outreach, education, and assistance; rebates and incentives; ordinances and codes; and conservation-based rates.
- Examining options for augmentation, including opportunities for water and water rights transfers on a willing buyer—willing seller basis; development and acquisition of additional supplies from outside the county; treatment of brackish groundwater; and the potential for direct potable reuse of reclaimed water.
- Drought planning, including strategies for curtailing demand during shortage.

Often, these actions and investments are best implemented on a regional level, with local water providers partnering with each other and, in some cases, state and federal governments, providing more cost-effective, efficient, flexible, and successful solutions. Ongoing regional dialogue and discussion will continue to be critical to identifying and developing opportunities and initiatives to enhance water management and meet future water demand.

These investments are primarily financed through bonding and water rates. Other funding mechanisms include:

- Impact fees on new development.
- Ad valorem property taxes assessed in Arizona's three most populous counties for the purpose of constructing recharge projects and paying for excess CAP water to be stored underground by the Banking Authority to offset future shortages.
- Water Infrastructure and Finance Authority (WIFA). WIFA is an agency of the state of Arizona and is authorized to finance the construction, rehabilitation and/or improvement of drinking water, wastewater, wastewater reclamation, and other water quality facilities and projects. Generally, WIFA offers borrowers below market interest rates on loans. As a "bond bank," WIFA is able to issue water quality bonds on behalf of communities for basic water infrastructure. WIFA also manages a Planning and Design Assistance Grant Program. This program offers planning and design grants to eligible wastewater and drinking water systems. The purpose of the grant program is to help prepare water and wastewater facilities for future infrastructure project construction.
- The Arizona Department of Water Resources Water Management Assistance Program provides financial and technical resources and assists in the development and implementation of conservation programs, augmentation programs, and programs to monitor hydrologic conditions and assess water availability in the Active Management Areas (AMAs) of the state. The program is funded through a portion of the groundwater withdrawal fees paid annually by those who withdraw groundwater in the AMAs.
- Competitive funding opportunities, such as the Bureau of Reclamation WaterSmart Program.

AMWUA members have often pooled funding to accomplish regional objectives. Examples include:

- Expansion of Roosevelt Dam.—Roosevelt Dam was modified in the 1990's to increase storage capacity on the Salt River to capture additional flows in wetter years. A coalition of six AMWUA members, along with the Bureau of Reclamation, Federal Highway Administration, Salt River Project, Central Arizona Water Conservation District, Arizona Department of Transportation, and Mari-

copa County Flood District, funded the \$424 million dollar expansion that increased the dam's capacity to nearly 1.7 million acre feet (of which nearly 305,000 acre-feet is new conservation space allocated to the six AMWUA members).

- Construction and operation of underground storage projects.—Underground storage is a cost effective alternative to surface water impoundments to store excess renewable water supplies for future withdrawal and use. In most cases, a water provider's existing well system can be used to withdraw water which has been stored underground when it is necessary to recover the stored water.
- CAP/Salt River Project (SRP) Interconnection Facility.—The CAP/SRP Interconnection Facility (CSIF) allows for the conjunctive management of water supplies from the Salt and Verde Rivers and the Colorado River—the watersheds that provide the majority of Arizona's renewable surface water resources. Completed in 1990, in partnership with six of the AMWUA members and at a cost of \$10 million, the CSIF provides a link between the CAP and SRP water delivery systems, increasing the Valley cities' ability to take their Colorado River allocations and put them to direct use or store them underground at local recharge projects. The CSIF has also facilitated water exchange agreements between SRP and CAP that has allowed SRP to supplement its surface water supplies during low-runoff years on the Salt-Verde system.

Groundwater management has played an enormous role in improving water supply reliability since the State's adoption of the Groundwater Management Act in 1980. In an effort to reduce reliance on groundwater, the AMWUA members have developed diversified water supply portfolios consisting of multiple surface water sources, as well as extensive reuse of reclaimed water. Today, AMWUA's members rely on groundwater for only seven percent of their water supplies. As a result, groundwater is largely preserved for use when there is a shortage of surface water supplies in the future.

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RESPONSES OF TAYLOR E. C. HAWES TO QUESTIONS FROM SENATOR LEE

*Question 1.* What do the study's projections of water supply and demand suggest for the future for threatened and endangered species in the basin? How might these changes impact ongoing water project operations and related conservation programs? Are there certain endangered species or conservation programs that you expect to be more imperiled by these trends than others?

Answer. There is no question that the Basin Study's projections suggest increased competition for limited water resources in the Colorado River Basin, if no action is taken. Increased use of the flows of the Colorado River Basin could pose risks to currently listed species and those at risk of listing. The Conservancy currently sits on the management committees of the Upper Colorado River Endangered Fish Recovery Program, the San Juan River Basin Recovery Implementation Program and the Lower Colorado Multi-Species Conservation Program. We are not involved in the Grand Canyon Dam Adaptive Management Program. Consequently, my responses will focus on the former three programs and in particular the Upper Basin Recovery Program, where we have been involved since its inception.

The successes of the Upper Colorado Recovery Program and San Juan Recovery Program and related state specific efforts show that we can meet all needs, including those of fish and wildlife, with careful and flexible water management, good science and a collaborative approach. Because water rights management is largely governed by state laws, it is vital to have early federal/state cooperation on the issues identified by the Basin Study.

The Upper Colorado Recovery Program and the San Juan Recovery Program are critically important forums that have demonstrated cooperation, commitment and success in conserving threatened and endangered species while allowing water development and management activities to continue. They have been shown to be adaptable to changing conditions and we hope they will continue to receive strong federal, state and tribal support. I have attached the 2012 Briefing Book from the two programs documenting their progress and success. They are model programs demonstrating that protecting the environment and water supply do not have to be in conflict.

At the state level, Utah established a model water rights leasing program designed to keep native fish off of the endangered species list. Under this law, passed in 2008 and amended earlier this year, private groups may lease water rights from landowners and agricultural producers for use instream to benefit native trout. This state program uses the free market to foster collaborations that can benefit both irrigators and the environment.

Water users and conservation stakeholders must work together to explore additional management tools, such as an Upper Basin Water Bank, that could benefit cities and rivers and protect the region's agricultural economy. Reclamation's Basin Study follow-up process provides a viable path forward to address these challenges. Moreover, proactive action is the key to avoiding any new species listings.

*Question 2.* In your opinion, are conservation programs in the basin adequately coordinated on a basin-wide scale?

Answer. There are four major recovery programs in the Basin. The Bureau of Reclamation and U.S. Fish and Wildlife Service are involved in all four programs, so there is cross-over and coordination across those agencies. In addition, there are organizations like The Nature Conservancy, water providers, and tribes whose representatives participate in multiple recovery programs. This overlap in membership provides additional informal coordination. Several years ago, there was also a basin-wide researchers' conference that included all four recovery programs, and the Upper Colorado and San Juan Recovery Programs hold an annual researchers meeting. Gatherings like these facilitate sharing of information, techniques and lessons. It would be valuable to hold basin-wide science meetings periodically to ensure that we can learn from each other's successes and failures.

In addition, it may be worthwhile for the federal agencies to ensure there is coordination among related programs of the Department of the Interior and the U.S. Department of Agriculture, including water, habitat and soil conservation and salinity management programs of the Fish and Wildlife Service, Bureau of Reclamation, Forest Service and Natural Resources Conservation Service. There may be ways to simultaneously reduce red tape for agricultural producers and achieve greater conservation benefits if these programs are more closely coordinated. Such coordination could help avoid duplication of effort and maximize the use of limited federal resources.

*Question 3.* How would you characterize the implementation of adaptive management in the basin to date? Has it been successful? What are the challenges for adaptive management, and how what do they tell us about the prospects for the options outlined in the Supply & Demand study?

Answer. The recovery programs mentioned above are all adaptive management programs. Monitoring and adaptation are critical elements of successful recovery. In particular, the Upper Basin and San Juan recovery programs have diverse participants who bring their science and technical expertise to bear to understand fish population and habitat trends and develop solutions for species recovery. In the two Upper Basin programs, we are seeing signs of recovery, especially in Colorado pikeminnow populations. There are no perfect strategies. Therefore, monitoring and then adapting offer our best chance at recovering the Basin's endangered and threatened fish species.

There is one major challenge relative to adaptive management and results of the Supply and Demand Study. Water supplies are expected to decline over time and demand continues to increase. The combination of these factors means that we will likely have less flexibility in water management. This will require federal, state, tribal and municipal agencies and non-profit conservation groups to be even more creative and collaborative in finding ways to meet the needs of cities and wildlife while also maintaining a viable agricultural sector.

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#### RESPONSE OF TANYA TRUJILLO TO QUESTION FROM SENATOR UDALL

*Question 1.* In your testimony, you mentioned that the Basin States have confirmed their ongoing commitment to take further action in conjunction with the Basin Study. Can you describe some of those proposals?

Answer. In conjunction with the release of the Basin Study in December 2012, the Basin States prepared a document summarizing their ongoing commitments to address supply and demand issues within the Colorado River Basin. A copy of the Basin States' Commitments to Future Actions Following Release of the Basin Study is attached for the record. As was noted during the July 16 hearing, the Basin States and our water users have long recognized the potential for an imbalance between supply and demand in the basin if proactive measures were not taken to conserve and otherwise efficiently use water and/or to continue to develop additional supplies of water. The Basin Study was another tool to help the states and water users plan for the future. It provided another opportunity for the Basin States to work together and to confirm their ongoing commitments to encourage more conservation and develop additional supplies.

The Basin States have noted that regional solutions such as water banking and joint funding of projects that conserve and more efficiently utilize water are effective



mechanisms that should be continued and expanded. The states and certain water users have also jointly funded programs to increase supplies within the basin. Additional projects will continue to be developed in conjunction with the Basin Study's "next steps" process and other ongoing efforts.

#### RESPONSES OF TANYA TRUJILLO TO QUESTIONS FROM SENATOR LEE

*Question 1.* Salton Sea restoration played a role in the negotiations of the 2003 Quantitative Settlement Agreement. What is the current status of Salton Sea restoration efforts?

Answer. The Colorado River Board of California is not directly involved with the restoration of the Salton Sea. The Salton Sea Authority, a Joint Powers Agency within California (Saltonsea.ca.gov), has been established under California law and is actively working on Salton Sea restoration issues. The status of Salton Sea restoration is also the subject of the most recent "River Report" produced by the Water Education Foundation, (Summer 2013 "Finding a Solution for the Salton Sea", <http://www.watereducation.org/doc.asp?id=876>).

*Question 2.* Legal challenges began soon after the adoption of the Quantitative Settlement Agreement. Are those challenges over with the June 2013 ruling that upheld the validity of the 12 contract agreements, or are there outstanding legal challenges? Are there any lessons to draw from the QSA experience for the future of efforts to manage future water supply and demand in the Colorado River basin?

Answer. On July 31, 2013, the Superior Court of California issued its final Statement of Decision affirming the Quantification Settlement Agreement (QSA), in a state court proceeding consolidating several cases relating to the QSA (QSA Coordinated Civil Cases, No. JCCP 4353). As of the date of this response, the County of Imperial has indicated that it may appeal that decision but the deadline for filing appeals has not yet expired.

A federal court lawsuit relating to the QSA is awaiting a decision by the Ninth Circuit Court of Appeals. The case was filed by the County of Imperial and Imperial County Air Pollution Control District. They have appealed a judgment granted in favor of the federal defendants by the district court. (People of the State of California ex rel Imperial County Air Pollution Control Dist. et al. v. United States Department of the Interior, et al., Ninth Circuit Case No. 12-55856.)

The QSA and the quantification of water entitlements within California have allowed the California agencies to implement many of the very successful programs that continue to assist California in meeting its critical water supply needs. Negotiation, compromise, and cooperation from diverse interests can lead to comprehensive programs that can have widespread benefits throughout the Colorado River Basin.

#### RESPONSE OF T. DARRYL VIGIL TO QUESTION FROM SENATOR UDALL

*Question 1.* I understand that Reclamation is now conducting a tribal water study as part of their next steps. What is your recommendation for the best way to include tribes in the on-going planning process?

Answer. The best way to include tribes in the on-going planning process is for the Bureau of Reclamation to establish a formal meeting process that includes the Basin States and the Tribes. When the Ten Tribes Partnership was initially formed in 1992, the Tribes were invited to attend and to participate in meetings with the Bureau of Reclamation and the Seven Basin States regarding water issues in the Colorado River Basin. While this practice was never formally adopted, over time, the practice of including the Tribes ceased. We recommend the initial process be re-instituted and that the Bureau establish a formal meeting process that includes the Basin States and the Ten Tribes. This will ensure that the Tribes will be included in all future water planning processes.

#### RESPONSES OF T. DARRYL VIGIL TO QUESTIONS FROM SENATOR LEE

*Question 1.* The Colorado River Supply and Demand Study indicated (page ES-21) that in early 2013 Reclamation would consult and work with tribes regarding tribal water rights issues reflected in the report. What consultation with tribes has occurred? What are the Ten Tribe Partnership's priorities for federal action to address Colorado River water supply and demand?

Answer. Representatives of the Bureau of Reclamation and the Ten Tribes' legal/technical committee have held meetings this year regarding tribal water rights issues but there have not been any formal "consultations" between the Bureau and Ten Tribes. The meetings that have taken place centered on defining the scope of work that the Bureau's technical staff and the Ten Tribes' legal/technical committee

will focus on during the tribal water study as part of the “next steps” to implement solutions to resolve imbalances in the Basin. Agreement has been reached by the Bureau’s technical staff and the Ten Tribes’ legal/technical committee on having future meetings regarding the tribal water study.

The priorities of the Ten Tribes Partnership’s for federal action to address Colorado River water supply and demand include the need for the Bureau to:

1. Acknowledge and protect the early priority of tribal water rights.
2. Recognize and protect the unused allocation of the tribes’ quantified water rights.
3. Recognize and protect the unquantified tribal water rights.
4. Recognize the special status of tribal reserved water rights that is embodied in federal statutes and federal and state case law.
5. Provide a seat at the table for the Partnership for participation in meetings between the Bureau and the Basin States.
6. Require that the Colorado River Simulation System model quantify the extent of the reliance of water users on decreed and undecreed rights of tribes not being fully exercised.
7. Provide a mechanism for voluntary transfers of water such as leasing.

*Question 2.* What lessons about future tribal water challenges in the Colorado River basin can be drawn from the current drought conditions and experience with federal programs and basin water management?

Answer. The drought and the Tribes’ experience with federal programs and with basin water management highlight the following challenges:

1. The Tribes cannot develop future tribal water use with non-existent or failing infrastructure and limited funding.
2. The Tribes’ need enhanced opportunities to gain economic benefit from their water resources.
3. The Tribes need to participate in dialogue at the Basin level by sitting at the table with the Bureau and the Basin States.
4. The Tribes must be treated more equitably relative to the Basin States and Mexico.
5. Congress must continue to support financial resources for the on-going study such as the WATERSMART Program and the Secure Water Act.
6. The Tribes must be allowed to investigate conservation practices, augmentation of supply, ground water storage, water banking, desalinization, environmental, power generation, agricultural, municipal, industrial, domestic, recreational and cultural practices in order to address these challenges.

#### RESPONSE OF REAGAN WASKOM TO QUESTION FROM SENATOR UDALL

*Question 1.* When you examine agricultural transfers as a potential future supply to meet growing municipal and industrial demands, how do you see the diverse needs of these stakeholders being met, given the long term certainty desired by municipal and industrial users versus the reliable supply also needed by the agricultural community?

Answer. Permanent voluntary transfer of agricultural water to municipal and industrial interests is the most common transfer mechanism and is generally deemed mutually beneficial for the buyer and individual seller. It is the third party interests that are most likely to not have all of their needs addressed in these transfers. Examples might be remaining shareholders lower in the ditch system that see more shrinkage losses on their water supply, or the local community that experiences a loss of jobs, or a local agricultural supply operation that loses an important customer from an already thin market base.

Temporary transfers can work very well and actually benefit both agriculture and M&I interests and when local water markets function well, providing agriculture with a source of revenue and a spot market for those needing additional water during or following drought. There are a few examples of this in the Basin, such as the Arizona Water Bank. However, it should be noted that cities need a permanent source of water to meet demands and that temporary transfers are useful mainly for coping with drought or refilling reservoirs following drought. These temporary mechanisms are not well suited for base supply if other options are available.

Bottom line is that there is not enough water to meet all of the needs in the Colorado River Basin, particularly when you factor in the need for enhanced environmental flows. Market based solutions are desirable, but public policy solutions that can lead to augmented water supplies are also important, particularly for sustaining our ability to produce food in the Colorado River Basin.

## RESPONSES OF REAGAN WASKOM TO QUESTIONS FROM SENATOR LEE

*Question 1.* The Colorado Water Institute is partially funded through the programs authorized under the Federal Water Resources Research Act; the Colorado Legislature also provides financial support. How have recent federal funding issues affected operations at the Colorado Water Institute? How have recent federal funding issues affected the federal data being collected (e.g., stream gages) in the state?

Answer. The USGS chose to apply a greater percentage of the FY13 sequestration cut to the Water Resources Research Institutes, cutting our base funding by approximately 40% and completely eliminating the competitive national grant program. In the case of the Colorado Water Institute, these FY13 federal budget cuts resulted in the elimination of funding for one research project and a reduction of funding for an additional project at my Institute. The net result is that several students did not receive funding for their graduate work, and there were important research questions that could not be addressed this year. Our Institute also had to eliminate part of our technology transfer activities as a result of these cuts. Funding from Colorado State University and the State of Colorado allowed our Institute to fare much better than many of the other smaller Institutes that do not enjoy the support that we do in Colorado. If FY14 budget cuts are similar or worse, significant harm or closure will result for many of the Institutes. I expect the Colorado Water Institute will be harmed but will survive.

Stream gaging data and other critical water and natural resource data collection efforts will also be harmed by these cuts, hampering our ability to efficiently manage water resources during a difficult period of drought in the West. Retrograding our water infrastructure and information systems at the same time that water scarcity grows will eventually lead to crisis based decision-making, likely harming agriculture and other important sectors of our economy.

*Question 2.* From the Institute's perspective, what are the priority research needs in the basin? What would be the appropriate federal role in this research?

Answer. We need research based information on:

1. Development of policy and economic incentives for agricultural water use efficiency within the current legal framework of Basin states.
2. Development of advanced tools for measuring, monitoring and modeling crop consumptive use and irrigation return flows as we implement efficiency and conservation measures.
3. Determination of food production impacts and appropriate substitutions as water is voluntarily transferred out of agriculture in the Basin.
4. Management techniques to enhance use of marginal water and reused water for agriculture in the basin.
5. Development of policy and economic incentives for establishment of robust water markets that can move water across the Upper and Lower Basin states.
6. Quantification of base flow and flushing flow needs for specific reaches of the river that are likely to have future disruptions based upon species listings. Development of flexible arrangements to avoid further listings and provide adequate habitat and refuge for species in these specific reaches.
7. Desalination technology

The appropriate federal role in this research is providing federal funding through the existing programs such as WaterSmart and the Water Resources Research Act, leadership in establishing research priorities, coordination across federal agency research programs to avoid duplication and optimize data sharing, and providing incentives for state and local matching funds.

*Question 3.* Given your research on municipal and agricultural water conservation and efficiency efforts, how can investments in conservation and efficiency most effectively address the imbalance in water demand and supply in the basin? What are the most effective means to prompt these types of investments?

Answer. In the case of agricultural water conservation, the most effective investments are likely to be economic incentives based upon developing functioning markets targeted for specific irrigation districts where a market based solution can result in significant quantities of transferable water.

Irrigated agriculture is going to need technical and financial assistance to implement conservation measures that benefit sectors other than agriculture, particularly when expensive upgrades in diversion structures and irrigation equipment are the best mechanisms to achieve greater efficiency. This assistance has historically been provided through various USDA and USBR programs. Federal cost sharing programs are historically the most effective mechanism to leverage local and state investments. In addition, federal attention to the aging infrastructure needs associ-

ated with federal water storage projects and irrigation canals is important to maintaining and increasing overall water use efficiency.

*Question 4.* Your research has included research on water quantity and quality issues associated with coal bed methane in Montana and Wyoming. From this experience, what are some priority data or research needs associated with energy sector water use in the Colorado River basin?

Answer. We must move forward aggressively to develop technology and incentives for cost effective recycling of produced water and hydraulic fracturing flowback. Additionally, technology to reduce water use for energy production and cooling is needed. Impaired and produced waters must be treated and put to beneficial use to the full extent practicable so that fresh water is not used in energy exploration and production processes where marginal water can be substituted. Efforts to collect data tracking the amount or percentage of produced water and frac-flowback water that are recycled by the energy industry would be helpful.

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#### RESPONSES OF DON A. OSTLER TO QUESTIONS FROM SENATOR LEE

*Question 1.* Concerns about energy sector water use have increased in some areas of the Upper Basin in recent years. How would you characterize the significance of this water use compared to the other water supply and demand challenges in the basin? Are there unique features of energy sector water use that are of particular concern, and how effectively are the current institutional and legal arrangements both at the basin and state levels addressing this water use?

Answer. The energy sector of water use in the Upper Colorado River Basin has the potential to become very large and significant, however the amount of development and the pace of development are extremely uncertain. There are widely varying estimates of future energy sector water demands. Conversely, it is also possible that certain portions of the energy sector (deep oil and gas wells which produce water) could introduce new water sources from deep aquifers into the basin if properly treated for quality purposes. Added to these uncertainties is the fact that water demands for various activities in the energy sector are also rapidly changing with new technology. In my opinion, the legal and institutional requirements are in place in the states to properly regulate water use within the energy sector now and into the future. Energy projects must acquire legally valid water rights from the States to use water for their projects. If water is not fully allocated in the area, they must follow the same process as any other entity to develop a new water source. If water is fully allocated, they must acquire or purchase valid existing water rights in order to proceed. Market values and existing laws govern such developments. I personally do not believe that water use regulation is the proper vehicle to determine the type of land use that is allowed in a given region. That should be done through proper planning and zoning. There are no basin-wide water requirements that are imposed on any given sector. Water is allocated basin-wide to each state and the states regulate individual water uses.

*Question 2.* Are there any Upper Basin near-term priorities for federal action to address Colorado River water supply and demand?

Answer. The Upper Basin continues to need financial assistance and technical support from the Bureau of Reclamation through the Water Smart program to assist us in development of a basin wide plan to address supply and demand imbalance in the entire Colorado River Basin. The Department of the Interior needs to continue to push and assist the Lower Basin States to address their current lack of sustainability in water use. The current imbalance of supply and demand in the Lower Basin, even absent drought, will have negative effects on water use in the upper basin as well due to coordinated reservoir operations. The lower basin currently uses more water than a normal compact allotment provides on an annual basis.

*Question 3.* Which federal programs in any federal agency most influence how water is used in the basin by either influencing the demand for water or how water is supplied?

Answer. The NEPA program and Endangered Species Act have significant impact on the ability to supply water to meet growing demands. The Salinity Control Program within the Bureau of Reclamation has a positive influence on how water is supplied to insure the quality is suitable for downstream uses.

*Question 4.* What data collected by the federal agencies would be most helpful in improving basin water management decisions?

Answer. The federal government has recently decreased funding for USGS stream gages and snow measurement stations (SNOTEL). This data is needed to help make

sound supply management decisions. Additional climatological stations are also needed to better assess water use from agriculture.



## APPENDIX II

### Additional Material Submitted for the Record

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CORRECTION “FOR THE RECORD” OF THE PREPARED STATEMENT OF KATHLEEN FERRIS, EXECUTIVE DIRECTOR, ARIZONA MUNICIPAL WATER USERS ASSOCIATION

A small but significant error exists in the information we provided regarding their water use trends on page 8 of Kathy Ferris’ July 16 testimony on the Colorado River Basin Supply & Demand Study.

It currently reads:

“Between 1980 and 2010, the City’s population increased by 83 percent, yet the City’s total per capita demand increased by only 35 percent and its total water production increased by only 18 percent.”

It should state:

“the City’s total per capita demand *decreased* by 35 percent”.

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STATEMENT OF THE GOVERNOR’S REPRESENTATIVES ON COLORADO RIVER OPERATIONS: STATES OF ARIZONA, CALIFORNIA, COLORADO, NEVADA, NEW MEXICO, UTAH, AND WYOMING

THE SEVEN BASIN STATES’ COMMITMENTS TO FUTURE ACTIONS FOLLOWING RELEASE OF THE BASIN STUDY

#### *Background*

The Colorado River Basin Water Supply and Demand Study (Basin Study) is the most recent example of the Seven Colorado River Basin States (Basin States) and the Bureau of Reclamation (Reclamation) working together to address Colorado River water supply and demand issues. The possibility of future water supply and demand imbalances has been identified since the 1960’s. For example over 30 years ago, the study, The Westside Study Report on Critical Water Problems Facing the Eleven Western States (Reclamation 1975), concluded that in spite of conservation, the Basin faces future water shortages unless its natural flows are augmented by more than 2.5 million acre-feet/year, or water-dependent Basin development is limited. With this knowledge, the Basin States and Reclamation have taken several actions to begin to address the potential for imbalance between future supplies and demands.

The Basin Study is the most comprehensive effort to date to quantify and address future supply and demand imbalances in the Colorado River Basin. The Basin Study evaluates system reliability and also outlines potential options and strategies to meet or reduce imbalances that are consistent with the existing legal framework governing the use and operation of the Colorado River. A range of future water demands are quantified in six different demand scenarios that include varied assumptions about future economic conditions, population growth, and water needs for agricultural, municipal and industrial, energy, minerals, and fish, wildlife, and recreation purposes.

The Basin Study considers four different water supply scenarios and is the first Basin-wide study conducted by the Basin States and Reclamation that considers the potential influence of climate change on future water supply. As described in Technical Report B—Water Supply Assessment, the climate change scenario, called the Downscaled Global Climate Model (GCM) Projected scenario, was developed using 112 downscaled GCM projections and shows a median projected decrease in mean flows of about 9 percent on average over the 2011-2060 period as compared to the 1906-2007 period. For comparison sake, the 25th and 75th percentiles show a decrease of 1 percent and 16 percent, respectively. Although this variation indicates

the need for additional research to better project climate changes on the Colorado River Basin, the results strongly suggest that the Colorado River system is vulnerable to possible changes in water supplies resulting from a drier climate.

The Basin Study's four different supply scenarios and six different demand scenarios present a broad range of possible imbalances. However, when comparing the median of the six demand scenarios combined with the median of four different water supply scenarios, a Basin-wide imbalance of approximately 3.2 million acre-feet/year by 2060 is plausible. Moreover, the greatest increases in demand are projected to occur in the Lower Basin. The Basin Study also illustrates that because of the magnitude and distribution of the imbalances, no single solution will be adequate to meet all future water demand and supply imbalances.

The Basin Study confirms that the Basin faces a range of potential deficits between future water supply and demand and that these possible deficits will require diligent planning and implementation of water supply and demand management programs to help avoid severe shortages and provide necessary supplies for future demands throughout the Colorado River Basin. The flow of the Colorado River is highly variable and given this fact, diligent planning and implementation of water supply programs will need to include portfolios that combine options and strategies that both address supply and demand imbalances and also take advantage of higher flow years. Local, state, regional, and Basin wide projects will all be needed to meet demands over the 50 year planning horizon to ensure that the Basin can develop to its full potential.

The Basin Study identifies a range of measures to address the supply and demand imbalance. Several options proposed during the public comment phase of the Basin Study raise serious legal and policy issues. Without the foundation of existing law, some options and strategies would require significant changes impacting a wide variety of local, state, and federal entities and resulting in increased uncertainty and risk. The Basin States will discuss all options submitted, however, they are committed to taking future actions that fit within the "Law of the River".

#### THE SEVEN BASIN STATES' COMMITMENTS

##### *Additional Conservation and Reuse*

The Basin Study recognizes that many municipal agencies in each state have implemented water conservation and reuse to meet the water needs of their growing populations and have incorporated comprehensive conservation programs into their planning to meet future demands. These conservation reductions are included in the forecast of future demands in the Basin Study. Municipal conservation can only be implemented step by step, providing a balance between water rates, demand elasticity, and demand hardening during droughts. Municipalities will continue to evaluate additional conservation and reuse, over and above what is already reflected in the Basin Study demand scenarios, and implement necessary programs on a case by case basis considering local conditions.

In many states, significant agricultural conservation programs are already in place. Additional agricultural conservation, above that already included in the calculation of demands, will require significant additional investment. Agricultural water transfers are being implemented within the Law of the River, represented for example by forbearance of agricultural water use, and new transfers are under evaluation in many states. Many of the states are also exploring alternatives to permanent agricultural transfers, and these types of alternatives are being further analyzed and implemented. Only projects that actually reduce consumptive use will reduce the imbalances between future supply and demands. This Basin Study identifies additional conservation and transfer opportunities that will be considered by entities as appropriate through local and/or state measures. While these local and state programs will offer a partial solution in some areas of the Basin, they may be, in many cases, problematic because much of the water diverted for use within the Basin returns to the river or a tributary for use by others downstream.

##### *Regional Solutions*

Water banking has been ongoing in the lower Basin for many years. A number of water banking options were submitted for consideration by the Basin States and Reclamation. A representative water banking option was included within the Basin Study to conceptually explore water banking. This option demonstrated that there are a number of legal, policy, and institutional barriers to implementing an Upper Basin water bank, however, the benefits associated with this option clearly demonstrate the need for additional exploration and analysis of this and similar concepts.



There are many watershed and regional solutions already being implemented and explored by the states and water agencies. For example, the states and water agencies have jointly been funding weather modification pilot programs for over five years as well as land and vegetation management options. All of these regional solutions are outlined in the Basin Study. The Basin States and relevant water agencies are committed to evaluating and implementing programs and options that have the greatest potential to yield additional supply. Although generally observed to be effective, the potential to generate additional water can vary significantly from year to year, and it is often very difficult to quantify the additional amounts of water generated at particular locations within the river system. Accordingly, regional implementation of these options would likely need to be used to augment the river on a Basin wide basis.

#### *Desalination and Importation Solutions*

The large demand and supply imbalances projected at the latter part of the planning horizon can realistically be met only with implementation of a variety of options and strategies. Of the options analyzed, only large scale desalination and importation projects provide the reliability and quantity of water necessary to meet many of the plausible projected supply/demand imbalances. Future population growth in the Basin, the uncertainty of the reliability of the Colorado River supply and long lead times for implementation of projects, dictate that the Basin States and the Federal Government must start evaluating options for developing such project(s) immediately. For example, permitting and construction of large scale desalination projects may take 20 years or more before the projects become operational. The Basin States, in cooperation with appropriate Federal agencies will form a partnership to immediately begin developing a process to consider feasible options for developing large scale desalination and/or importation project(s), with the goal of having such project(s) in operation before the end of the planning horizon (by 2060).

#### *Other Commitments*

Modification to the operations of Lakes Powell and Mead was implemented in 2007 through the "2007 Guidelines" and will be effective through 2026 with re-consultation to occur no later than 2020 or if Lake Mead reaches an elevation of 1,025 feet. The Basin Study does not contemplate any changes to the 2007 Guidelines. Within the context of the 2007 Guidelines, Basin States' representatives will begin discussions of additional measures or approaches to be taken at a Lake Mead elevation of 1,025 feet.

The Basin Study has again demonstrated to Reclamation and the Basin States the great interest in the future of the Colorado River by a wide variety of stakeholders—tribes, recreational entities, power providers, environmental organizations and conservation groups. As work continues following the completion of the Basin Study and based on its recommendations, the Basin States and Reclamation will continue to work with key stakeholders to explore solutions.

The Basin Study provides tools for water resource planning for the Colorado River Basin. The Basin States will work with Reclamation to evaluate progress regarding consideration of options listed in the Basin Study, evaluate the ability to use the tools developed for the Basin Study, and update water demands and supply scenarios on a five-year time frame. In addition, the Basin States will work with Reclamation to support improvements in the modeling and analytical tools used in the Basin Study and the information developed to support those tools, including those improvements specifically described in Appendix C5 of Technical Report C—Water Demand Assessment.

The Basin States will work with local, state, and federal representatives, and a wide array of diverse and interested stakeholders, to obtain funding to aid in the assessment and implementation of the above listed initiatives.

#### ARIZONA DEPARTMENT OF WATER RESOURCES

The Colorado River is a critical resource for the long-term health and economic welfare of the State of Arizona and its citizens. The Arizona Department of Water Resources (ADWR) is charged with promoting, protecting, and managing Arizona's annual apportionment of 2.8 million acre-feet of Colorado River water. ADWR represents all mainstem water users including the Central Arizona Project (CAP). Arizona's apportionment is used for municipal, industrial, agricultural, Tribal, and wildlife refuges purposes. Annually, the mainstem Colorado River users utilize approximately 1.2 million acre-feet of Arizona's apportionment. The CAP diverts the remaining 1.6 million acre-feet of Colorado River water for its customers in Central Arizona (Maricopa, Pinal, and Pima counties).

Arizona, in particular CAP and many mainstem users, is unique among the Basin States due to its vulnerability to the impacts of shortages from its junior priority status consistent with the Law of the River. In total, 6.2 million Arizonans, most of whom live within the CAP service area, and nearly 800,000 acres of irrigated agricultural land rely on Arizona's Colorado River allocation. Therefore, Arizona, especially CAP and other mainstem entitlement holders, are vitally interested in enhancing the current and future reliability of Colorado River system through augmentation and other means to meet current and future Arizona water needs.

APPROVED:

SANDRA FABRITZ-WHITNEY,  
*Director.*

#### COLORADO RIVER BOARD OF CALIFORNIA

The Colorado River Board of California has authority under California law to investigate, coordinate, collate, and preserve information, facts, and data bearing upon the Colorado River System and to confer with representatives of other States in the Colorado River Basin, representatives of the United States, and other concerning the development of water within the Colorado river Basin and the use of the water of the Colorado River System.

APPROVED:

BART FISHER,  
*Chairman.*

#### COLORADO WATER CONSERVATION BOARD

The Colorado Water Conservation Board (CWCB) was established in 1937 to guide the development and protection of water resources for the benefit of present and future Coloradans. Through policy implementation, financial support for water projects, and participation in statewide as well as nationwide programming, the CWCB strives to most effectively utilize this valuable resource. This fifteen member Board and professional staff work with the federal government, neighboring states, and water users within Colorado to strike a balance between necessary development and environmental protection. The CWCB serves as Colorado's primary guide for water policy in all of the state's river basins, as well as administration of major compacts, decrees, and treaties.

APPROVED:

JENNIFER GIMBEL,  
*Director.*

#### COLORADO RIVER COMMISSION OF NEVADA

##### SOUTHERN NEVADA WATER AUTHORITY

The State of Nevada participants in the Colorado River Basin Study include the Colorado River Commission of Nevada (CRCN) and the Southern Nevada Water Authority (SNWA). The CRCN is a State authorized agency responsible for securing and protecting Nevada's rights and interests in the Colorado River and in electric power generated by the river. The SNWA is a political subdivision of the State of Nevada and is responsible for addressing Southern Nevada's water needs on a regional basis. The SNWA represents seven member agencies including the Big Bend Water District, the City of Boulder City, the City of Henderson, the City of Las Vegas, the City of North Las Vegas, Clark County Water Reclamation District, and the Las Vegas Valley Water District. The CRCN and the SNWA work cooperatively to effectively manage Colorado River water resources for the State of Nevada and water users in Southern Nevada.

APPROVED:

JAYNE HARKINS,  
*Executive Director, Colorado River Commission of Nevada,*  
PATRICIA MULROY,  
*General Manager, Southern Nevada Water Authority.*

#### NEW MEXICO INTERSTATE STREAM COMMISSION

The New Mexico Interstate Stream Commission (NMISC) is authorized by statute to do any and all things necessary to protect, conserve and develop the waters of the state, including representing the state of New Mexico's interests in the allocations made to New Mexico under the Colorado River and Upper Colorado River Basin compacts. In addition, the NMISC looks after the interests of all Colorado River water users within the State of New Mexico. The use of Colorado River water

is vital to the economic health and public welfare of the state of New Mexico and its citizens and includes water used for municipal and industrial, irrigation, and tribal purposes while providing fish and wildlife, recreational and environmental benefits within the San Juan, Little Colorado, Gila and Rio Grande basins.

APPROVED:

ESTEVAN LOPEZ,  
*Director.*

#### UTAH DIVISION OF WATER RESOURCES

The Utah Board of Water Resources (Board) and the Division of Water Resources (Division) were established to develop and protect the water resources of the State of Utah for the benefit of present and future citizens of Utah. Through policy implementation, water resource planning, and financial assistance for water projects, the Division and the Board work to effectively utilize this precious resource. As the Governor's representative for interstate streams, The Division represents Utah to coordinate work with the federal government, neighboring states, and water users within Utah to achieve the goals of protecting our scenic natural environment while maintaining the vital use and development of water to promote the wellbeing and economic vitality of Utah on behalf of its citizens.

APPROVED:

DENNIS J. STRONG,  
*Director, Utah Interstate Stream Commissioner.*

#### STATE OF WYOMING

Water in Wyoming belongs to the State. The Wyoming State Engineer is a constitutionally-created office and is Wyoming's chief water official with general supervisory authority over the waters of the state, and of its appropriation, distribution and application to recognized beneficial uses. The State Engineer is entrusted with the duty to preserve Wyoming's water allocations to safeguard the State's current and future water supplies. The Wyoming legislature has conferred upon Wyoming officers the authority to cooperate with and assist like authorities and entities of other states in the performance of any lawful power, duty or authority. Wyoming and its State Engineer represent the rights and interests of all Wyoming appropriators with respect to other states.

APPROVED:

PATRICK T. TYRRELL,  
*State Engineer.*